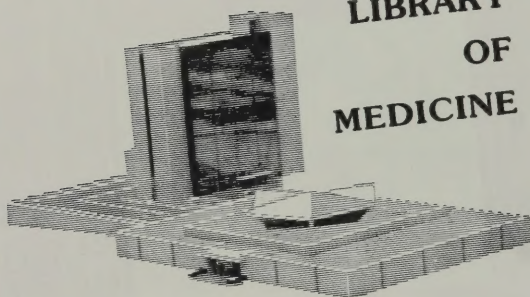


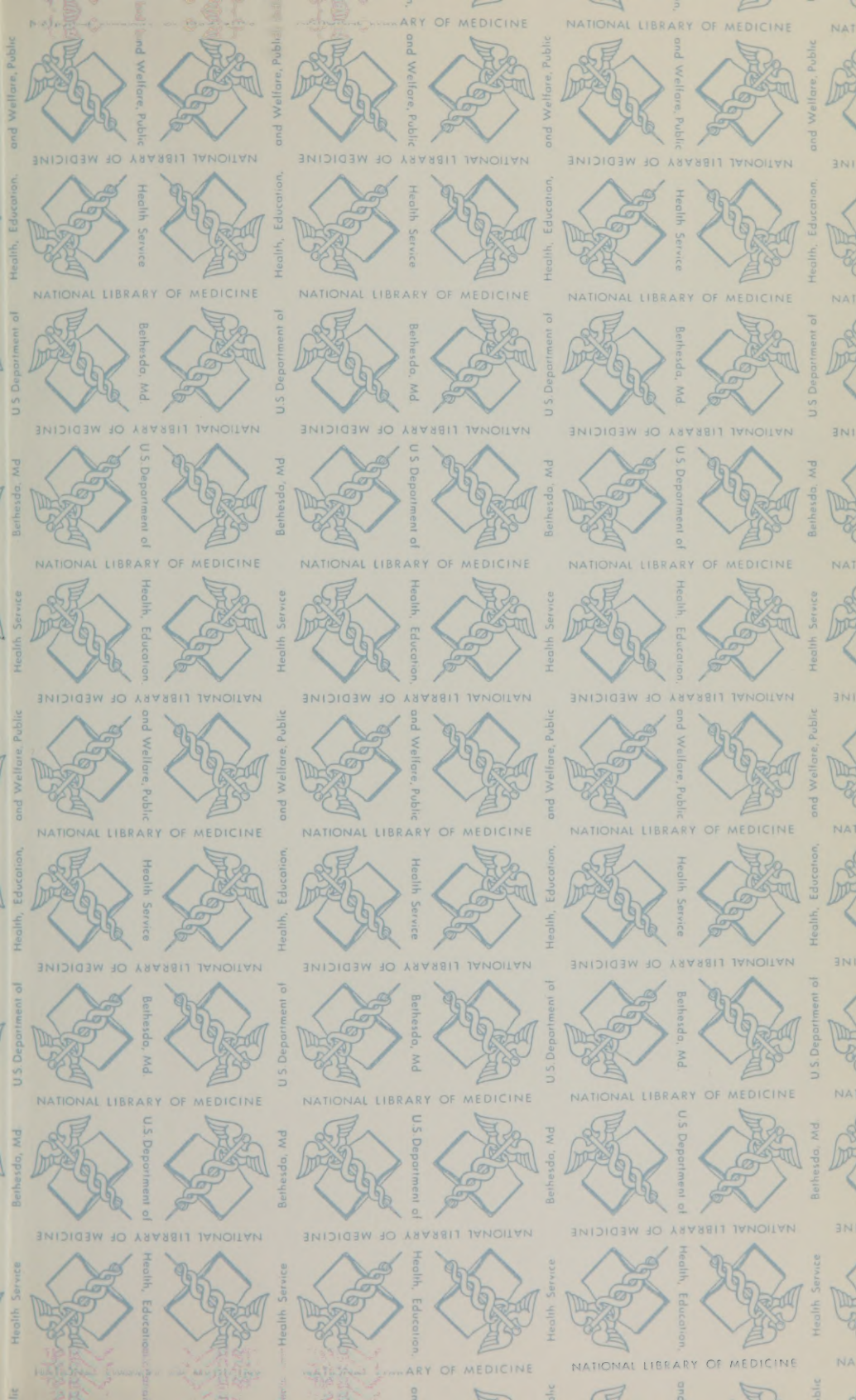
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CONSERVATIVE GYNECOLOGY

AND

ELECTRO-THERAPEUTICS

A PRACTICAL TREATISE ON THE DISEASES OF WOMEN AND
THEIR TREATMENT BY ELECTRICITY

BY

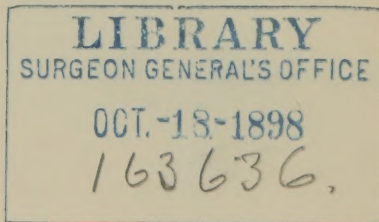
G. BETTON MASSEY M.D.

PHYSICIAN TO THE GYNECOLOGIC DEPARTMENT OF HOWARD HOSPITAL AND LATE ELECTRO-THERAPEUTIST TO
THE INFIRMARY FOR NERVOUS DISEASES; FELLOW AND EX-PRESIDENT OF THE AMERICAN
ELECTRO-THERAPEUTIC ASSOCIATION; MEMBER OF THE SOCIÉTÉ FRAN-
ÇAISE D'ÉLECTROTHERAPIE, AMERICAN MEDICAL
ASSOCIATION, ETC., ETC.

THIRD EDITION

REVISED REWRITTEN AND GREATLY ENLARGED

Illustrated with Twelve (12) Original Full-Page Chromo-lithographic Plates and
Twelve (12) Full-Page Half-tone Plates of Photographs taken
from Nature and Numerous Engravings in the Text



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PREFACE TO THE THIRD EDITION.

THE exhaustion of the second edition of the author's work on "Electricity in the Diseases of Women" necessitated the preparation of a third edition some time since. In preparing the material for this purpose it was found desirable to rewrite and restate so many of the facts connected with the application of electricity to the diseases of women, in order that the very latest advances in this subject might be adequately represented, that an entirely new book was the result, dealing more fully than heretofore with the nature and causation of the diseases of women in which electricity is urged as a rational remedy, as well as discussing in full detail the many minor points which are essential to success in its employment.

What was originally a mere treatise on the use of electricity in fibroid tumors and certain other affections has thus been transformed into a treatise on the medical and surgical diseases of women, with special reference to the therapeutic use of electricity. This broadening of the scope of the work has been made necessary by the fact that nearly all of the modern treatises on gynecology have been written from a purely surgical stand-point, leading often to a perspective view of these affections that unduly exaggerated the mechanical side of pelvic pathology. Opportunity is thus afforded for the rescue from oblivion of certain neglected facts as to the origin and nature of inflammatory diseases of the uterus and adnexa, and for the fuller consideration of the neural disorders most frequently found among women, while special attention is accorded to fibroid tumors and their treatment by the Apostoli method, and to the author's method for the treatment of cancer.

As a treatise on the diseases of women no claim is made that it covers the field so ably occupied by the works on abdominal and pelvic surgery alluded to, but only that it covers ground of more value to the average physician and his patients than books devoted to the details of operations that, however necessary at times, are often only properly of service as last resorts, and are then incapable of application except at hands that have had more than a book-training.

Besides, in the present redundant condition of the physician's bookshelves, no author has a right to burden his readers with attempts at comprehensiveness which transcend the immediate bounds of his personal experience, and when he confines himself to that experience and its teachings he has fully discharged his duty both to his readers and to science, without implying that the experience of others is not also of value.

With all modesty, therefore, but with a lively appreciation of the importance of the facts and methods herein detailed in enabling the progressive physician to save his patients from the dangers of both neglect and of misapplied methods of treatment, the author commends this work to his professional brethren and bespeaks for it a share of attention and kind consideration at least as great as that accorded to each of its predecessors.

Thanks are due to Mr. Xanthus Smith, the well-known artist, for the accuracy of the illustrations that appear here for the first time.

Instead of reproducing the now classical drawings of the motor points of the nerves and muscles, it was thought best to secure greater accuracy by verifying each point on the person of a professional model and then photographing the living subject. Plates VIII and IX are, therefore, half-tone reproductions of actual photographs, and it is hoped that this method of depicting the real situation of these points will lead to greater ease in their location than has been the case in the past. The services of a professional model were also invoked in the more realistic delineation of the therapeutic procedures shown in Plates III to VII.

In preparing the series of colored plates showing the appearance of the cervix and uterine discharges in typical cases of disease, in which Mr. Smith was engaged in pioneer work in medical illustration, special thanks are due to Drs. J. Montgomery Baldy, W. A. Newman Dorland, Frank W. Talley, Theodore A. Erck, Oliver Hopkinson, and Carrie Chase Davis for facilities afforded in securing the typical cases from which sketches were made.

1636 WALNUT STREET, PHILADELPHIA.
JUNE, 1898.

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PART I.

CHAPTER I.

THE NATURE AND PREDISPOSING CAUSES OF THE MORE COMMON AFFECTIONS OF WOMAN.

Developmental Faults of Early Womanhood.—The girl is the antetype of the woman in physical as well as mental endowment; hence the prophecy of a wholesome maturity, or the seeds of many of the physical and neural ills of womanhood, may be traced in the heredity received plus the environment of her developmental stage. Under the unrestrained operation of the laws that govern evolution the all-pervasive influences of an awakening womanhood tend toward the more perfect establishment of its character in the individual, and would doubtless, in later generations, produce women of increasing womanliness, physically and mentally; for natural selection between the sexes is apt to be governed by inherently correct mutual attractions. The conditions of civilization and the demands of society, however, do much to nullify rather than increase such wholesome tendencies, and the result of marriages as usually contracted is often the production of stationary or atavistic progeny.

Under the operation of unwise or accidental sexual selection we may have, therefore, the descent of an acquired heredity of physical weakness or emotional impressionability,—conditions which, if associated with a non-corrective environment, are sure to result in disaster to the life-history of the individual. In heredity we have, consequently, a most potent cause for the developmental faults of early womanhood.

The influence of environment either in perfection or correction of girlish character is peculiarly powerful in her stage of development, for, contrasted with that of man, this stage of development involves

phenomena of a far greater relative importance, the physical and mental phenomena that bear a direct relation to sexual characteristics impressing every fibre of her being, her emotions, and her judgment. Nature has, herself, therefore, made the hygienic path of girls narrower than that of boys, for, in endowing them with the susceptibilities of highly specialized functions, it has furnished another predisposing cause for disease, in the shape of a special vulnerability to unfavorable environment.

Since heredity is beyond the control of living beings (and society even yet refuses to apply well-known rules of scientific breeding to its unborn children), it is to the correction of environment that both parents and physicians must look for reparative effects, and it is fortunate that environment may be, at times, as effective in producing results as heredity itself.

In the scientifically-bad environment we have the second, but most practically important, cause of developmental faults in young girls. Striking portions of this are: influences which cultivate selfishness and neglect inculcation of that wholesome instinct of self-sacrifice in little matters which does so much to ennoble womanly character; influences which favor introspection as to bodily ills and cause undue attention to be paid to little aches and pains that would be forgotten were more attention paid to active duties and pleasures; lack of earnest occupation for body and mind; lack of out-door life; mental cramming, with neglect of physical education in schools; neglected excretions; unhygienic dress.

It is well-known that hysteria is rarely or never found except in girls who have, at some time, suffered from that unfortunate mental discipline known as "spoiling"; but it is not so well appreciated that its earliest evidences may be traced in the habit of selfishness and self-indulgence in little things, and that this habit long fostered requires but little else to produce the disease. Of lack of mental occupation it may be remarked, in passing, that there are but two attitudes toward the problems of her immediate future that are mentally healthy for young girls: they must either cultivate society and a natural interest in the young members of the opposite sex among their acquaintances, or they must devote unflagging energies to some real pursuit or occupation. It is the more retiring and prudish girls who, while neglecting the career of a social favorite, and failing to replace its mind-absorbing duties and pleasures by an equally absorb-

ing career or occupation, fall early victims to neurasthenia and other nervous troubles.

Some of the instances of bad environment enumerated are fortunately fast disappearing, but many of them are still most conspicuous and active enemies of womanly health and perfection. The hygienist of to-day has much to be thankful for in the changing conditions governing the lives of intelligent girls and women, thanks to the somewhat recent elevation of health and vigor into an idol of fashion. Protests are still made against waist-borne clothing, it is true; but much of this is hypercritical, for it cannot be easily demonstrated that the shoulders, suspended from the chest as they are by mere muscular and ligamentous attachments, are better adapted to support clothing than a bony prominence, such as the hip, which is superposed directly on the bony structures of the thigh and leg. The question is entirely apart from that of tight lacing, than which nothing could be more injurious to the organs of the abdomen and pelvis. That our grandmothers could have existed within their "stays" is but an evidence of physiologic endurance. Their grand-daughters are more sensible; yet the physician, and the artist also, must still bewail a fashion that not only constricts the waist to an improper degree, with consequent displacement of internal organs, but destroys the vigor, pliancy, and independent activities of the abdominal and dorsal muscles, resulting in weak backs, weak abdomens, and palpable distortion of the abdominal contours.

Besides inculcating the preventive measures naturally indicated by the mere suggestion of such and kindred faults of environment, the physician should not hesitate to welcome and advise the sensible use of the bicycle by young girls, under the important conditions of an anatomically correct saddle, an upright position on the wheel, and proper moderation in its use. With these conditions secured, one can be certain that a valuable hygienic measure has been attained which will not only prevent, but even cure, maldevelopment of the secondary puberty, when so many of the disorders of young womanhood arise.

Among the most serious maldevelopments of young girls is an imperfect evolution of the menstrual function in which this evidence of maturity is attended with undue pain. This subject is fully considered in the appropriate chapter; but in this summary of the underlying causes of the affections peculiar to women it is proper to note that the author regards these conditions as strictly neural or inflam-

matory, or a combination of both, and that his experience has enforced the conclusion that the mechanical-obstruction theory of menstrual pain is a wide-spread delusion and totally unsupported by the facts. No damming up has ever been observed in these cases, nor has it been proven that the narrow or tortuous uterine canal is not still capable of giving exit to the menstrual fluid supposed to be held back by it. Until actual obstruction can be proven it is evident that the elaborate operations of slitting up or dilating the cervix are illogical and harmful, the few instances in which it has apparently been of service in allaying pain being equally explainable on the theory of this effect being actually due to the cure of the hyperesthesia. It is evident, on the contrary, that the pain, as a rule, precedes the flow, and, in the absence of an expansion of the uterine cavity above the internal os, it is clear that it precedes the actual secretion of the fluid itself.

Common sense alone would indicate, therefore, that undue menstrual pain is a reaction between vasomotor conditions within the affected organs and their nerve-centres, the remote causes being either a bad local or general nutrition and development, or consequences of catarrhal invasion. This view is, of course, not entirely new, and is even found in text-books that dictate methods of treatment entirely founded on discredited mechanical theories, but it needs the impetus of a vigorous propaganda to be brought home to the consciousness of gynecologists at large, and to dictate a less mechanical and more effective treatment and one more in accordance with the true nature of the condition.

But our concern here is more with the original causation of this affection, and this aspect of the question is the more important since it bears a direct relation to the possibility of preventing one of the most common complaints of young womanhood. Why should so many girls complain of these intense pains and cramps at the occurrence of a purely physiologic and normal cyclic point in their routine physical life? Varying amounts of discomfort and nervous erethism are probably natural, but this invalidism in health surely is not.

We have here heredity and environment again,—an heredity of neuropathic tendencies,—if combined with a neurotic environment being fully capable of furnishing a ready subject for the affection, which in its earlier stages can be none other than an intensification of the normal congestion of an imperfectly-developed and imperfectly-

nourished apparatus. And we might also consider the environment of the pelvic organs themselves, when a habit of constipation causes them to be crowded and their blood-supply diminished and vitiated.

But two additional influences are now required to develop a merely neurotic functionation into one attended with pronounced menorrhspasm and menorrhagia, the first step establishing the uterine form and the second the ovarian form of the disease: 1. If, coincident with this undue physiologic congestion the patient catches cold, with its microbic and neural causation, we have an endometritis, constituting the uterine form of menorrhagia. 2. The second step is the upward extension of the catarrhal aggravation of normal congestion until the ovaries are affected, which is favored by additional exposure to cold, artificial stimulation of the sexual organs, the contraction of a marriage while still uncured, and, finally, it is to be said, with regret, that the operation of divulsion for the cure of uterine menorrhagia is too frequently followed by an extension to the ovaries.

Disorders of Maturer Womanhood.—With the regular establishment of the monthly cycle in her nature, woman has an ever-recurring test of her well-being, which is also, in a manner, a tax upon the associated functions of catabolism and anabolism, nutrition and waste, to which it is correlated through the sympathetic nervous system. To this, in the connubial state, is added the full performance of a function which, normally conducted, adds distinctly to her well-being, but which is too often attended with a lack of common sense, prudence, and temperance that would put the so-called lower animals to the blush. Throwing aside instinct, which regulates so beautifully the connubial relations of these same lower animals, man has failed too often to replace it with proper intelligence and control, and the result is, at times, harmful to the general well-being of the individual. The effect of excess in frequency alone is often sufficient to deceive both patient and physician into the belief that a diseased condition exists. If to this be added an abnormal performance of the function with the intent to prevent conception we may have the pains and aches and weight sensations of actual disease, which, of course, baffle the physician and his remedies so long as the cause continues to be repeatedly invoked.

Little need be said, in this place, of the causative influences derived from the necessities and accidents of pregnancy and child-birth, as these are fully evident to any practitioner and are usually rather

overstated than understated from the mechanical point of view. It is, indeed, a marvel how great are the changes involved in the evolution and involution of the maternal organs in this physiologic process, without residual change, and especially so when it is remembered that the evolution is so often interfered with by tight lacing in younger women. Involution is, nevertheless, so well conducted by nature under ordinary conditions that, unless interfered with, the parts are restored very nearly to their ante-impregnated condition in a surprisingly short time. Many cases of gynecic complaints arise, nevertheless, in interferences with this normal involution, the chief varieties of interference being either traumatism or infection.

Of traumatisms the most important is laceration of the cervix uteri, for the reason that the laceration permits an easy entrance to the germs of catarrhal inflammation, which is a most important concomitant of subinvolution of the uterus. It is nevertheless a mistake to confound the morbid effect of the laceration in this early stage with its relative importance in the later stages. The theory of Emmett as to the pathologic importance of healed tears of the cervix has been enormously overdone, particularly in this country, where the operation of trachelorrhaphy has been so frequently performed for either general nervous symptoms or actual disease of the uterus supposed to be due to it. The connection is clearly fanciful and has no analogy in similar causes of disease in any other part of the body. To get at its true value one should look carefully for cases of old lacerations and compare the symptoms of those in which the laceration alone exists, without concurrent chronic inflammation of the uterus, with those in which this condition is also associated. It will be found that the simple laceration is without symptoms, except the occurrence of early miscarriages when the tear has been deep. This clearly indicates that the chronic metritis is the true cause of the symptoms.

In catarrhal invasion of the uterine and tubal mucous tracts we have, indeed, the true cause of the great majority of the pelvic diseases of women as they present themselves to the active practitioner. Some of these are, of course, gonorrheal in origin,—the worst cases, in fact; but that very many are entirely free from any etiologic connection with the gonococcus has been most abundantly demonstrated. The germs of ordinary purulent inflammation are practically ubiquitous, and are ever ready to attack a mucous membrane in which the physiologic resistance has been reduced either by traumatism, func-

tional abuse, or the peculiar and as yet poorly-understood neural influences of "catching cold."

That non-specific microbial invasion, with its sequential war of cells between the microbes and the phagocytes, is at the bottom of the great bulk of common pelvic diseases is as evident as that a similar catarrhal process is the principal pathologic condition in chronic nasal affections. There is also a further analogy between the most common conditions of the two mucous tracts in the readiness with which the catarrhal affection spreads upward by continuity of tissue, in the one case affecting the Fallopian tubes and ovaries and, in the other, the Eustachian and nasal tubes, the ear, and the eye. An important conclusion to be drawn is that the initial lesion in the uterus or nose should receive primary attention in any therapeutic effort. This is fully acted upon, I believe, by the ophthalmologists and otologists, and was formerly well understood in relation to the uterus, but the nature of the uterine therapeutics then in vogue—the application of caustics, etc., to the cervix or within the cavity—was of a character to frequently aggravate the upper extensions of the affection. It might justly be said, of these methods, that they were directed to the uterus rather than to the affection as a whole, with a proper inclusion of its original and still persistent seat in the uterus.

The recent surgical school, whose opportunities for actually seeing and handling diseased tubes and ovaries has justly brought this portion of the genital mucous tract into prominence, has somewhat naturally fallen into the opposite extreme of neglecting the residual affection of the uterus while paying all attention to the tubes and ovaries; and, when the mode of relief selected consists in simple removal of the latter organs, has been confronted with a continuance of the symptoms from the portion of the affected structures left behind.

Catarrhal disease of the utero-tubal tract is itself an entity and should be dealt with as a whole rather than in some of its parts. That it is totally lacking in malignancy, and ordinarily susceptible of a more curative treatment than that by a removal of some of the organs affected by it, is too evident to be insisted upon were not an opposite practice so common.

And it should be distinctly understood that if we eliminate uterine or more general pelvic inflammation with its results in interstitial hyperplasias with or without morbid adhesions, or, to state it

more practically, if these conditions be cured, we need take no account of the exact position of the uterus except it be retroflexed to the second degree or prolapsed at least to the same degree. This organ is normally movable and capable of considerable deviation from its position at rest; hence fixation in the normal position is even worse than a movable displacement. While the badly displaced, yet movable, uterus will give symptoms due to the displacement itself, much of the discomfort is really due to the concurrent endometritis or hyperplasia, and though it is impracticable at times to so tone up the weakened supports as to enable them to regain their functions, we may at least relieve them of added labor by reducing the bulk of the uterus to normal. With this help a complete restoration may be ultimately gained without resorting to the temporary expedient of pessary wearing, which only adds to the atrophy of the natural supports.

CHAPTER II.

ON THE EXAMINATION OF CASES WITH REFERENCE TO THE PROPRIETY OF EMPLOYING CONSERVATIVE METHODS OF TREATMENT.

It cannot be said that the physician who is skilled in the application of electricity and other conservative methods in gynecology has as great a moral responsibility for accurate diagnoses as the surgeon, for the cost in lost functions or lost lives of the surgeons' mistakes are out of all proportion to any consequences of the mistaken diagnosis of the former. Yet a responsibility for accuracy in diagnosis and treatment is inherently associated with all medical work, and in no department of therapeutic management is the importance of an accurate conception of the true nature of the disease of more value than in electro-gynecology, for in this work both the indications of treatment and the special technique of applications to different affections are unusually clear. There is, moreover, a two-sided responsibility involved in the examination of cases with a view to the propriety of electric treatment, for, while desirous of making all possible applications of an art that is capable of restoring health in so many cases *without injury or loss of organs or risk to life*, the physician should not make the mistake of counseling the employment, or attempt to employ, this method in cases where the blessings of modern aseptic surgery are both *proper* and *expedient*. It is the abuse and not the proper use of surgical methods that should be avoided.

The electro-gynecologist should therefore be a trained specialist in the diseases of women, in its fullest sense, though his highest usefulness will be lessened by a simultaneous ambition to be a great abdominal surgeon, for the temptation to use his surgical skill in that most attractive field may curtail his employment of electricity, which, though at times slow in producing cures, may, even in these tardy cases, yield the most brilliant results as a reward of patient persistence.

In certain classes of cases a training in neurology is equally im-

portant, for it is a heresy of the age, leading, at times, to dire results, that regards the diseases of women as merely mechanical and surgical.

And that the electro-gynecologist should, first of all, be a physician, in the broad sense of the designation, fully alive to the constitutional, diathetic, assimilative, and eliminative conditions of his patient goes without saying, for it is self-evident that the true specialist is only he that adds something to the broadest training of the well-educated physician.

Last, but by no means least, he should be thoroughly familiar with the physics of electricity,—an elementary subject that should be mastered by the student, together with other natural sciences, before he is permitted to enter a medical college. In default of this previous training, or in case of decided rustiness, the reader is advised to turn at once to the second portion of this work, where will be found a complete elementary introduction to general electro-therapeutics.

General Examination and Classification of Cases.—When a patient presents herself with a self-evident affection, such as a large neoplasm, either benign or malignant, or other patent condition well understood by herself and her previous medical attendants, there is no difficulty in at once placing the case in a general class for further special study. If, on the contrary, the pain, tenderness, weakness, or other subjective complaints point to merely an abnormal condition of functionation of some organ or group of organs, greater care must be exercised in this preliminary placement of the case, for it is particularly in this stage of examination that many women have been assumed to have pelvic disease who really suffered from some form of nervous, constitutional, or abdominal disease, the artificial ideas of the proper position and shape of the pelvic organs yet partially prevalent among gynecologists inducing the adoption of measures that had no bearing whatever on the real affection. Chronic constipation or other functional derangement of the digestive tract, and particularly displacements and dilatations of the stomach and large intestine and relaxation of the abdominal walls, have done duty for all manner of organic diseases of the pelvic organs. But it is in the mistaking of nervous affections for pelvic diseases that the errors of apparently good diagnosticians have been most numerous and harmful during the past twenty years, due to a conjunction of circumstances such as ignorance of neurologic science; ultramechanical ideas of the position and shape of the uterus; an exaggerated belief in the frequency, effect, and in-

curability of ovarian diseases; and an assumption that gynecology had no relationship to any other branch of medicine than surgery. It is to these facts that we owed the long-drawn-out epidemic of pessary wearing by women who had not the slightest need for such an unnatural and often harmful skeleton within the vagina, and that to-day we are far from blessed with the knowledge that, in the opinion of our misguided friends, about every third woman in the community must have her pelvic organs torn open, sewed up, scraped with vigor, torn loose from their adhesions, sewed up to the abdominal wall to form adhesions, cut out and put into alcohol, or otherwise disposed of. Aside from such bizarre experiences as the removal of an ovary for pain due, in reality, to lateral sclerosis of the spinal cord, and the removal of both ovaries for similar symptoms due to scoliosis of the spinal column, both of which instances occurred in cases known to the author at the hands of distinguished surgeons, my readers can doubtless recall scores out of the thousands of cases where equally vigorous pelvic treatment has followed attempts to diagnose nervous troubles obscurely pointing to the pelvis, and where the chief error of treatment was not due to a lack of the broad training that a specialist should possess, but rather to a failure to make a careful preliminary study of a case that was in itself inherently difficult of exact determination, yet which, if studied thoroughly, would have yielded negative indications at least for the radical measures employed.

It is therefore our chief duty, in these obscure cases, to determine the relation of the symptoms (1) to constipation, which is unusual in cases that are sent to the specialist in private practice, but frequent in general practice and dispensary work; (2) to other digestive, assimilative, or eliminative disturbances, such as gout, rheumatism, etc.; (3) to abdominal relaxation, gastroptosis, or enteroptosis; (4) to neurasthenia or hysteria; (5) to probable neuralgia of the pelvic nerves, as evidenced by sciatic or other neuralgias; (6) to organic affections of the spinal nervous system; or (7) to true pelvic disease.

The physician who is familiar with electric methods is placed at a distinct advantage in summing up the probability of which element in the case is the prime factor of the disease when confronted with an instance in which decision is difficult, for he may embrace both horns of the dilemma with the greatest propriety and with the best results to the patient. And as the truth in the cases of moderate pelvic disease associated with a functional nervous affection often lies

between the two as chief etiologic factors, no other course than the simultaneous treatment of both affections is equally effective without loss of time, money, and energy.

The ordinary questions of a careful note-taker as to family and personal history having formed the initial portion of the examination, it is immaterial whether this general examination and autoconsultation precedes or follows the local examination, provided it has a due place in the investigation and precedes the formation of an opinion.

Examination of the Abdomen.—The local examination of the patient, which should invariably be conducted with the assistance of

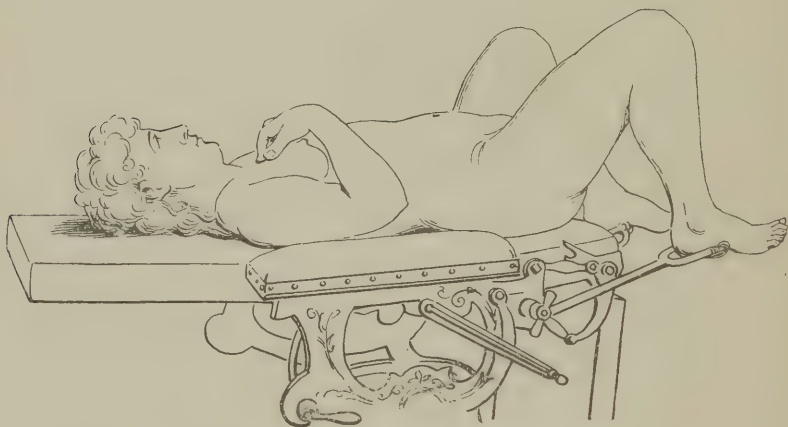


Fig. 1.—Dorsal position. (Drawn from photograph of model.)

a nurse or other third party, requires that the corsets be removed and all bandages about the waist loosened, permitting the whole abdomen to be readily examined. The patient having been placed in the dorsal position (Fig. 1) with bladder and rectum empty, the abdominal regions should receive the first attention, as inspection and palpation of this most important portion of the body will not only detect or exclude disease of its various organs, but will also give important information of the general nutritive condition of the patient. To proceed at once to the pelvic examination, as generally advised in the text-books, is to overlook very valuable sources of information.

Inspection will, in addition to the information afforded as to gen-

eral nutrition, give evidence of any existing or antecedent stretchings of the skin due to pregnancy, ascites, or tumors.

Palpation is most important in the general information which it gives and as a means for the discovery and the estimation of the nature, situation, and size of tumors. This should be conducted with the full palmar surface of the fingers, and not with the tips alone, and on the full education of the fingers in this art will depend much

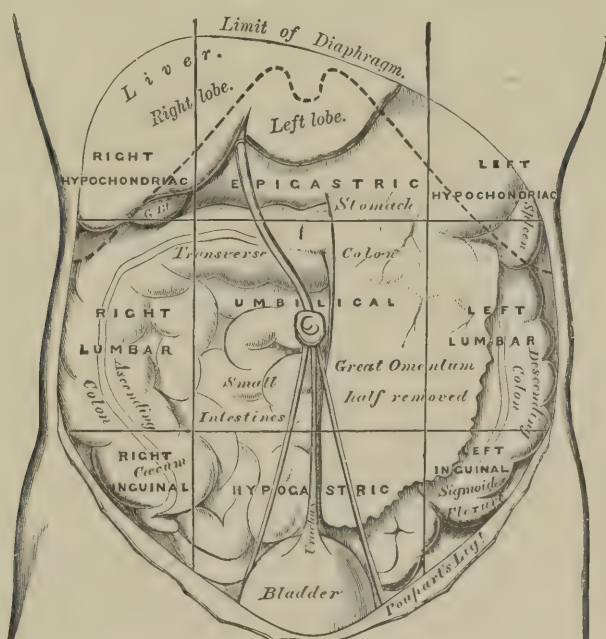


Fig. 2.—Diagram of abdominal regions, showing position of viscera. (After Gray.)

of the diagnostic skill of the examiner, the bimanual examination of the pelvis alone exceeding it in value. A form of bimanual examination of the abdomen may be of value in thin subjects in which the other hand is passed under the patient's back (Fig. 3). This will give important information concerning the true situation of the anterior hand in relation to the spinal column, the rim of the pelvis, the kidneys, and other normal structures, and permit of a more perfect appreciation of small abdominal tumors and displaced organs.

Mensuration.—In the larger tumors and abdominal enlargements exact measurements should be taken and recorded of the shape and size of the growth for subsequent reference in ascertaining the extent of shrinkage. The measurements are to be taken from certain fixed points appropriate to each case, such as: the height above the level of the anterior superior spines of the ilium, the distance above or below the navel, or the extreme height of the tumor from a less easily fixed point on the pubic symphysis. Measurements of the breadth of abdominal tumors may be made directly, or, in very large tumors, by



Fig. 3.—Bimanual abdominal palpation. (Drawn from model.)

taking the distance from each anterior superior spine of the ilium to the navel (in symmetrical tumors, directly from spine to spine).

Since increased health coincident with the retrogression of fibroids will, at times, be accompanied by an increased thickness or firmness of flesh in the abdominal wall, Apostoli advises that the thickness of a double layer of these tissues be taken by pinching them up in the hand and measuring with calipers. This is only of importance in accurate measurements of slight changes, for it is never great. The additional tone of the abdominal muscles under treatment is apt to

convey to the patient the sensation that any increase of bulk is really a decrease.

When the abdominal walls are relaxed, either with or without the association of tumors or other affections, the extent and importance of the relaxation is best determined by having the patient stand with abdomen uncovered or even by lying on one side. I have known patients who firmly believed that they possessed tumors, owing to the enormous relaxation revealed in the standing position, the true extent



Fig. 4.—Abdominal relaxation, as shown in the erect position.

of which tax upon her strength was far from evident in the dorsal position (Fig. 4).

Examination of the Pelvis.—*Dorsal Position.*—The patient remaining in the dorsal position, an inspection of the vulva is now made in a new case for the discovery of possible evidences of a specific condition, anomalies, or of relaxation of the vulvar outlet. The next step is the insertion of the forefinger to find the position of the os preparatory to the insertion of a bivalve speculum (Fig. 5) for

ocular inspection of the condition of the vaginal walls and muscular structures, the condition of the os as to the effect of previous accouchements, and the existence of laceration or of erosion. This portion of the examination has an important bearing on the accuracy of the diagnosis, since it not only informs us accurately of the existence of relaxation of the vaginal outlet and its nature and extent (Plate XIX) and of the condition of the vaginal surfaces, but by permitting us to see the nature, color, and consistence of the uterine discharges, if any exist, enables us to locate the origin of the discharge,—a most important step in the accurate treatment of these affections. (See Plates X to XVIII.)

Bimanual Touch.—Most valuable information of the condition of the uterine body as a whole, of the tubes, ovaries, and periuterine

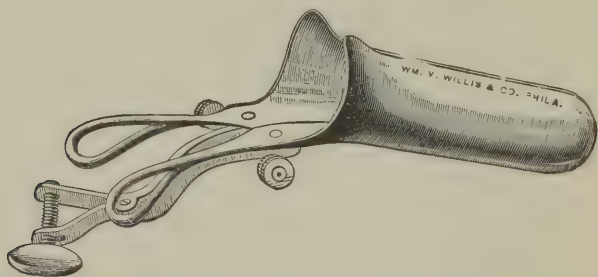


Fig. 5.—Goodell speculum, latest pattern.

space, is derivable from the next step of the examination,—the bimanual touch (Fig. 6), the cultivation of which creates the true *tactus eruditus* of the gynecologist. By the educated finger within the vagina, assisted by the educated fingers of the opposite hand palpating above, a tactile intelligence may be evolved only comparable to the education of the tactile sense in the blind, capable of mapping out with precision any morbid condition within the pelvis, unless the subject is inordinately obese. It is not claimed, of course, that the exact nature of the morbid condition may be thus determined, though the association of subjective and other objective symptoms may enable us to come very close to it; but it is claimed that the educated touch is capable of making a diagnosis that will fully warrant the institution or rejection of electric or other conservative treatment, if

it could not so easily warrant a major operation. An intra-uterine treatment constitutes also an additional means of diagnosis (page 114), as pointed out by Apostoli, thus rendering absolutely unnecessary that



Fig. 6.—Bimanual pelvic examination.

terrible alternative advocated by some,—an abdominal section for diagnosis.

The Sound.—Nothing has been said of the passage of the uterine sound (Fig. 7) for the simple reason that the author condemns it as a means of diagnosis in any form of uterine trouble except tumors, for the reason that all of its indications, except the depth of the cavity, can be determined with equal facility by the skilled bimanual touch.



Fig. 7.—Simpson's sound.

The depth of the cavity is of value as a means of comparison from time to time and may be taken during any intra-uterine applications that are made. An exception to this condemnation of the sound is

imperative in the first examination of fibroids and in the discrimination between these neoplasms and ovarian tumors or other periuterine tumors closely approximated to the uterus. When so used it should be inserted without a speculum by passing the tip along the index finger placed in the vagina, the instrument being held very lightly between the index finger and thumb of the opposite hand, thus enabling it to be inserted with the greatest gentleness. After engaging the cervix the handle is brought down between the thighs to enable the curved

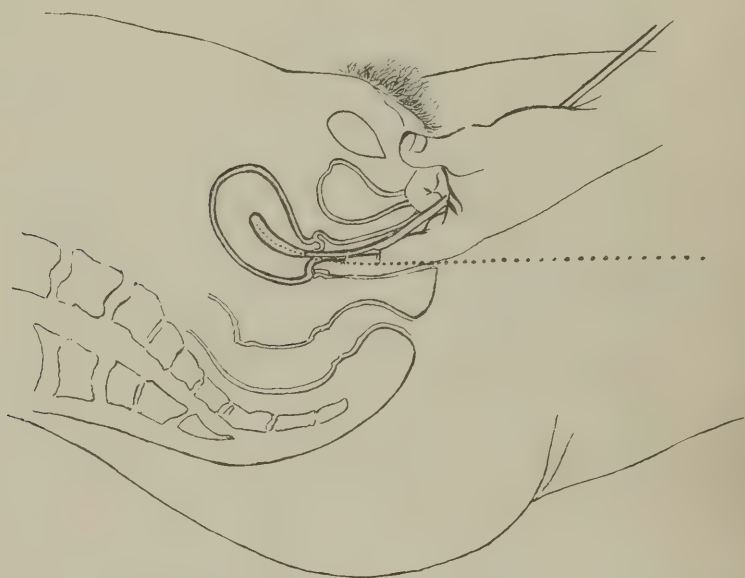


Fig. 8.—Method of inserting sound by touch. The finger is shown behind the cervix.

portion at the tip to coincide in direction with the cervix, as it is known to be at the moment by the touch, and when thus inserted it may be made to follow the actual direction of the cavity with least disturbance, the sound becoming a prolongation of the delicate tactile organs of the finger. This method of inserting the sound has been popularized by Apostoli, and, when one is familiar with it, its immense advantage over any other method in which the touch does not take part is most evident. The cut (Fig. 8) has been carefully drawn to

illustrate the method as practiced by the author, showing the finger behind the cervix, which it draws slightly forward when this portion of the uterus points too far back.

A method of insertion of the sound practiced by some, in which the cervix is caught with vulsella forceps and dragged downward, should be condemned as unnecessarily barbarous, liable to produce injury if the adnexa are adherent, and unable to convey to the operator any intelligent information as to the direction in which the instrument should be passed.

Abdominal palpation may be conjoined with the sound in the



Fig. 9.—Sims's position. (From photograph of model.)

differential diagnosis of tumors projecting above the pelvic brim, a slight movement being given to the uterus to determine whether it is intimately connected with the tumor.

Rectal Touch.—This is an important proceeding when the vaginal touch has disclosed obscure conditions in the posterior pelvic regions, and should be practiced just before the termination of the examination on account of the fingers becoming soiled. It is also of great value as a sole means of examination in virgins. The bimanual rectal touch is practiced in the same manner as the vaginal procedure.

Sims's Position.—The use of Sims's position and speculum (Fig.

9) are far less frequently necessary in the conservative treatment of the diseases of women than in operative procedures, though, at times, valuable in applications to the cervix and vault of the vagina and in electropuncture, though even in the latter operation the dorsal position is preferable for any but the most superficial punctures, on account of the use of the finger in directing the instrument. The proper attitude for this examination is shown in the cut, the side of the table on which the hips rest being slightly elevated to raise the vulvar outlet above the level of the vault in order that pneumatic pressure may dilate the vagina when air is admitted. The speculum (Fig. 10) should be inserted by separating the labia with the fingers of the left hand, holding the instrument in the right by its opposite extremity; the point of the blade is placed on the posterior commissure and slipped into the vagina in a backward and upward direc-



Fig. 10.—Sims's speculum.

tion. After adjusting the tip in a manner to bring the desired portion under view the instrument is intrusted to the nurse, who stands with her left side toward the patient (Fig. 11).

Illumination.—A good North light will generally be sufficient for an ordinary specular examination, but a more powerful illumination is of value in electrolytic operations on small neoplasms, etc., within the vagina. The methods of artificially illuminating the vagina, and also the technique and value of transillumination of the pelvis as an assistance to diagnosis, are fully treated on page 353.

Aspiration.—A most important occasional means of positive diagnosis in some pelvic and abdominal tumors where a cystic condition is suspected is the puncture of the tumor by a long slender needle with capillary tube, attached to an aspirator, by which we may determine the presence of a liquid and extract a portion of it for diag-

nosis, and also in certain cases as a remedial measure (Fig. 12). The delicate nature of these needles makes it possible to traverse many organs and tissues with impunity, though the careful operator will usually be able to insert it quite directly into the presenting portion of the tumor without taking unnecessary risks. The imprisoned sac in intestinal hernia, the bladder threatened with rupture, and the large intestine distended with gases have all been safely punctured with this instrument, and the needle may be used as a negative electrode when



Fig. 11.—Attitude of nurse in Sims's position. (Drawn from photograph of model.)

inserted into a tumor, if thought wise, after the liquid has been withdrawn, by previously coating it with a thin layer of fused hard rubber to a short distance of the point, and connecting it with the negative pole of the battery by twisting a fine copper wire about its base. When so used the hydrogen-gas and liquids of electrolysis are drawn into the aspirator reservoir in great quantity.

The aspirator acts, of course, on the principle of producing a vacuum in the reservoir-bottle by means of a suction air-pump con-

nected with it by a stout rubber tube, the needle being attached to another tube connected with the top of the reservoir.

Great care should be observed in asepticizing the needles and tubes before and after use, the needle being either boiled or passed over the flame of an alcohol-lamp immediately before use, no matter what the previous cleaning may have been, and the spot where it is to be inserted should be cleaned with sublimate solution if within the vagina or sublimate solution followed by alcohol if on the abdominal surface. Chloride-of-ethyl spray will make the external puncture painless.

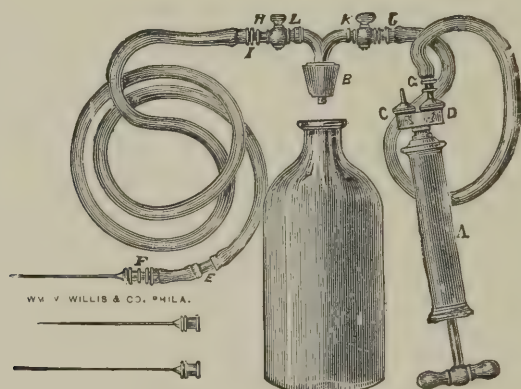


Fig. 12.—Aspirator.

Aseptic Precautions in Routine Gynecic Practice and Electrogynecology.—The hands, and particularly the fingers and finger-nails, should be scrupulously clean when making any examinations or applications, the use of the nail-cleaner, scrubbing-brush, and soap and water being amply sufficient when the mucous membrane is unbroken. No instrument of any character should be employed unless absolutely aseptic, the author making the following arrangements for this purpose: All sounds and intra-uterine electrodes are first thoroughly washed in soap and water and then passed through the flame of an alcohol-lamp or Bunsen burner, and no instrument of this nature is inserted into the uterus that cannot be so asepticized. All metal instruments likely to be injured by this heat, such as specula, forceps,

etc., are boiled before use. Electrodes with rubber insulation not fused on the shank, which I reject, if possible, in favor of those that have a fusible insulation, are dipped in boiling water and thoroughly scrubbed with soap and water, or are kept in a 3-per-cent. solution of carbolic acid or 10-per-cent. acetanilid solution. The electrodes with fusible insulation are heated in the flame and aseptized by re-fusing the covering. All cotton pads or other external electrodes that are used for more than one patient are boiled before use, a small gas-stove being very convenient for this purpose.

CHAPTER III.

INTRODUCTORY REMARKS ON ELECTRICITY AS A REMEDY IN GYNECOLOGY.

THE systematic use of electricity in certain affections peculiar to women had its inception in the labors of Tripier, who, as far back as 1859, began a series of publications that show a profound study of the value of electricity in the trophic and mechanical lesions of the uterus and other pelvic organs. Numerous and fruitful essays have appeared from the same pen at frequent intervals since, the whole amply sufficient in themselves alone to stem the tide of excessive surgical interference in gynecology that began simultaneously with his work, but outstripped it so widely. But Tripier has not been understood by his contemporaries. Electro-therapeutics itself and all writers on it were assumed to be concerned with nervous diseases alone, and what literature existed was inaccessible to gynecologists. It remained for Apostoli to successfully attract the attention of specialists in the diseases of woman by the persistent advocacy of his discovery of the value of scientifically-applied currents in the treatment of fibroid tumors, by methods that resulted in a distinct advance in the general application of electricity in medicine. This invasion of what had been regarded as an exclusively surgical field received conspicuous and bitter criticism from the many stalwart defenders of a faith that laid aside all else in gynecology but the knife. In America and England particularly the discussions have been numerous and acrimonious, and doubtless many extravagant claims appeared on both sides; but as a result it may be said that electricity has been rescued from its exclusive position as a toy in the hands of the neurologists, too many of whom intrusted its crude applications to unintelligent nurses, and has won for itself an important place in the curative therapeutics of gynecology. As a natural consequence, an improvement has also appeared in the application of electricity to nervous diseases,—a result that could not have been hoped for under previously-existing conditions.

Apostoli's work was, of course, but the medical application of

that swelling tide of electric knowledge that has so suddenly altered the mechanical surroundings of mankind. It was, indeed, high time that the recent advancements in electric science should be applied to medicine, its oldest service to man, when Apostoli described, in 1882, his device of the clay-pad diffusion-electrode for the painless dispersion, on the outside of the body, of the powerful, measured currents concentrated at will within. Conceived on lines previously enunciated by Erb, the method was the first demonstration since the era of electric measurement of the possibility of using really effective currents within the body.

How Electricity Becomes a Remedy.—The intimate connection between electricity and physiologic and pathologic processes has recently been considered by Prof. A. E. Dolbear, the eminent physicist of Tuft's College, Cambridge, Mass., in a paper read before the American Electro-Therapeutic Association at its Boston meeting in 1896. He deprecated all allusion to electricity as a force external to matter and independent of it. Electricity, light, heat, and chemic action are inherent properties of matter, electricity being the rotatory property of atoms, light the vibratory property, etc. They are but manifestations of atomic energy which are continuously present in the interchanges of atoms in the molecular activities incident to life. The higher the form of tissue, the greater the amount of energy absorbed in cellular activities.

“The factors of physiologic phenomena are the kinds of matter found in organic things and the kinds of motion and energy which give the kinds of matter their characteristic properties. The phenomena exhibited with these factors depends upon the inherent qualities of the atoms themselves, and it is certain that the old notions concerning their nature and possibilities must be profoundly changed, for the old is altogether inadequate and no one to-day knows enough to say what matter cannot do, for such a one makes ignorance do duty for knowlege. What can be strongly stated is that the variable factors are heat and electricity, for these determine chemic reactions, in the body as well as out of it. For a long time heat was the only physical factor employed for chemic purposes in inorganic processes. Lately electricity has been utilized and has made possible many reactions which were either impossible or required a long time to effect, such as the reduction of alumina, the tanning of leather, and the making of potassium chlorate and sodium carbonate. Is it not

altogether probable that the selective chemistry of tissues of all kinds is to be helped in like manner by employing the same agent, and that only present lack of knowledge prevents its successful use in promoting normal physiologic processes and destroying abnormal ones? Anthropologists are telling us there are few, if any, individuals of any race that are thoroughly sound, that all are in a more or less diseased condition. That means that cellular structure does not distribute to physiologic structure the proper kind and amount of physical energy needed. The trouble is with the cells, not the organs. And the trouble with the cells is instability due to lack of available energy, ultimately electric, if there be any truth in what seems to be implied in all molecular structure, for every atom has its electro-chemic equivalent or electric energy, which is disposed in this way or that as it is held more or less stable in its molecule."

This suggestive extract from Professor Dolbear's paper gives unquestionably the true basis of the medicinal value of electricity. In brief, it may be said that by its use we have a means of altering at will the molecular activities, the selective chemistry, of both superficial and deep-seated parts of the body, and this is done, not by the addition of foreign substances or even a foreign force to the body, but by a simple alteration of its cellular activity, on which all organic functions depend.

To affect molecular activities in a special organ, which may be deep-seated, it is therefore apparent that we must so concentrate our "current" of rotatory molecular excitation from some artificial source external to the body that it may traverse that organ and be dense enough in transit to accomplish its purpose. This current, which, if galvanic, is always issuing from its source in a definite direction, only circulates when the path back to its source or to earth is complete. To place the body in this path or circuit we must apply two conducting contacts (electrodes) to its surface or within its substance, between which the current will spread out as it traverses the intervening tissues. The electrode at which the current enters the body is called the positive pole, and is generally indicated by the + sign; that at which it leaves is called the negative pole, with the — sign. In addition to the molecular excitation referred to, which is present in all portions of the circuit through the body in proportion to the local density of the lines of flow, special chemic and molecular effects on living tissue attend the current at entrance and on leaving the body;

hence the two poles have distinct and separate physical and therapeutic effects (page 40).

It is only necessary to add to these hints at the mode of action of electricity as an internal remedy that an intensification of the same molecular activities by concentration of current is the explanation of the destruction of tumors of the body-surface and accessible cavities, where molecular activity is conducted to the final step of a resolution of tissue into its ultimate inorganic elements.

Special Value of Electricity in Gynecology.—The foregoing remarks indicate the basis of a wide applicability of electricity to the cure of diseased organs in general. That its value in chronic affections of many kinds is but imperfectly appreciated by the profession is only too true (and this may be largely imputed to its but recent availability in measurable quantity), yet there are two special reasons for its recent agitation as a remedy in the diseases of women. One of these is the prevalence of nutritional and functional affections of the uterus and adnexa readily cured in this way, and by currents easily made effective owing to an insensitive nerve-supply. The other reason is that it offers a choice of methods in a class of affections notoriously maltreated at present by methods almost invariably involving the sacrifice of organs.

It is, of course, by no means within the power of electro-gynecology to displace the really necessary work accomplished by the modern methods of aseptic surgery, but it is within its province to demonstrate that mutilating and sacrificial operations can be restricted to cases legitimately requiring such measures of last resort by revealing the curableness of many affections apparently regarded as hopeless. The extensive prevalence of an attitude that regards the removal of an organ as both the proper and the only way to cure it can only be regarded as the sign of a mental epidemic of no mean proportions, particularly when such attitude is maintained only toward one set of organs.

To check microbic invasion and its consequences, remove pain, restore function, correct nutritional faults, check hemorrhage, cause retrogression of benign growths, and restore local and general health is a sufficiently broad platform for a single agency, and, if these, or many of these, results can be accomplished by electricity without danger, risk, or mutilation, its claims for consideration as a method of choice over less advantageous procedures are imperative.

With powers so conservative, yet vigorous, at command, it is clearly the duty of the electro-gynecologist to protest against the too common practice that classes gynecology with major surgery alone, and results in sufferers from the diseases of women being referred at once to specialists in abdominal surgery. No organ should be subjected to a mutilating operation, certainly none removed from the body, until the powers of conservative medication have been intelligently tested; yet such is the haste in the performance of this work of last resort that our hospitals particularly have become the sacrificial temples of this new faith, in which women by the score, without previous attempt to cure, are persuaded to undergo operations dangerous to life and unwarranted by sound judgment, and which are followed by life-long consequences in those that recover that are either carefully concealed or else carelessly withheld from their knowledge before their consent is given.

Special Value of Electro-gynecic Applications to the General Practitioner.—Besides the opportunity that is afforded to the family physician in the reference of his more difficult cases to the electro-gynecic specialist for an application of the highest skill in the art to a truly conservative restoration of health, a mere superficial employment of this agent by himself is calculated to be of immense service to his patients in the cure of many deviations of function which may have seemed great enough to demand a reference to others. And this large field of usefulness is entirely wanting in risk, even in unaccustomed hands, if the vaginal methods of application are adhered to and the intra-uterine applications withheld until greater expertness is gained.

That a large proportion of the ordinary cases of pelvic pain and discomfort are mainly due to deficient muscular and nervous tone, to relaxation, to the consequences of sexual excess, and to congestions and inflammatory sequels easily removable by the stimulant and tonic effects of vaginal applications of the faradic current is well-known to every gynecologist who sees a large number of semi-acute cases, and there is no reason why these cases should not be treated by the intelligent general practitioner with an office practice, particularly when continued delay or the application of harsh remedial measures will lead to an intensification of the trouble. This was well illustrated by a story told by Dr. Laphorn Smith, of Montreal, who had recommended a physician to purchase a faradic apparatus, and on calling

at his office some time subsequently was surprised at its worn condition. The physician explained matters by asserting that he had cured a considerable number of cases by its use. Asked what had been the matter with the patients, he could only reply that he did not know, but that they had been cured, nevertheless. The interests of exact science condemn such blind empiricism and routinism, but, when it is remembered that the remedy employed by him is incapable of harm, no one can say that this physician was wanting in either common sense or humanitarian principles.

Limitations.—An attempt to assign exact limits to the medical usefulness of an agency such as electricity will remain impossible for some time, owing to the varied nature of the conditions attending its employment. One may believe, for instance, that ergot, iodine, or other material agent may be thus easily understood, but the agent, in this case, being *the intensification or alteration of the molecular activities in a controllable manner*, with immediate results varying through an enormous range of current-strengths and qualities, the field of usefulness is more widely varied, and it is probable that conditions yet regarded as incurable in this way may merely require a heavier or more skillfully applied current. It is true, nevertheless, that many limitations to its usefulness are at present apparent, in the discovery of which a large and constantly increasing list of valuable uses has been established.

No claims that electricity, or, in fact, anything else, is a cure-all is possible to the scientific mind, and, although these pages are largely devoted to a demonstration of its value in the definite conditions enumerated, it is not supposed that the reader is to neglect any simpler means that would be effective in the treatment of his cases; for approved medical treatment, including the use of internal remedies or of applications capable of being administered by the patient, are always preferable to remedial means that require the physician's personal attention, provided the same ends can be accomplished.

A similar discretion is also assumed upon the part of the reader in the choice between electricity and the knife, the former being advised only when it is equally certain in effect, free from danger, and more conservative of organs and their functions; and, unless experience shows us that all or most of these advantages are assured as a result of the electric treatment of a particular case, we should not lose time by its employment. It should not be forgotten, neverthe-

less, that in case of uncertainty on these points a course of electric treatment is incapable of doing harm, and, in the event of failure, leaves the patient in a position to derive full benefits from surgical treatment, which cannot be said conversely of patients who have failed of relief under a surgical operation.

CHAPTER IV.

PHENOMENA ATTENDING THE TRANSMISSION OF GALVANIC CURRENTS THROUGH LIVING ORGANS.

Physical Reasons for Electrode Coverings.—With low-pressure currents, such as the galvanic and faradic, it is essential that a good contact be made between any two parts of the circuit, since these currents have very slight power to jump through the air. In the human body the moist tissues are the conductors, which, in percutaneous applications, we find surrounded by an insulating envelope of dry cuticle, presenting, together with the slight layer of air between it and the dry metallic-electrode surface, a very large amount of resistance. One important purpose of an electrode covering is the maintenance of a moist conducting-joint between this metallic surface and the moist, subdermic tissue, the water contained in the covering not only blotting out the air-cushion beneath the electrode, but rendering the cuticle itself a better conductor by soaking it. It is true that a little current will be apt to pass from a dry metallic surface to the body with currents of a pressure of 50 or 100 volts (such as with the galvanic brush), but the lines of potential will be almost exclusively within the skin rather than beneath it. In other words, the energy of the current will be mostly expended here, making the application practically one to the skin only (see Experiment 5, page 313). Deep penetration of the current is then a prime reason for a well-moistened electrode covering, with the associated fact of a minimum of dermic action and pain. Another important use is the protection of the surface from certain chemic and electrolytic polar effects when they are not desired. When we wish to make use of these effects to their fullest extent provision is made for an immediate contact between the metal and moist tissue, as by puncture through the skin or by simple contact if it be a mucous surface.

Moist absorbent cotton, which was first recommended by the author as an electrode covering in 1885, remains, in his opinion, the most cleanly, easily applied and renewed, and generally useful material

for this purpose, the accuracy of its contact with the skin being, however, greatly increased by thoroughly soaping its surface. In 1882 Apostoli introduced well-moistened sculptors' clay as the material for

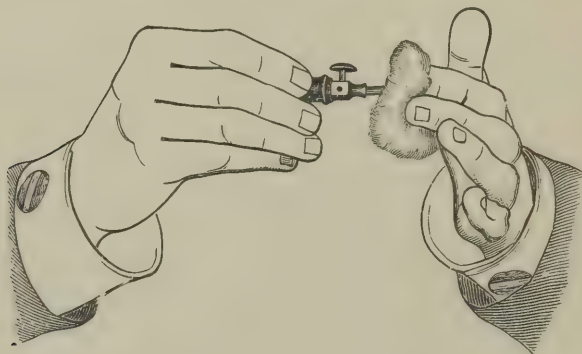


Fig. 13.—Applying absorbent cotton to electrode disk (first stage).

the large abdominal pad when it is desired to render one pole non-active, or capable of transmitting a large current with a minimum of sensation and local resistance at this spot. If thoroughly adhesive

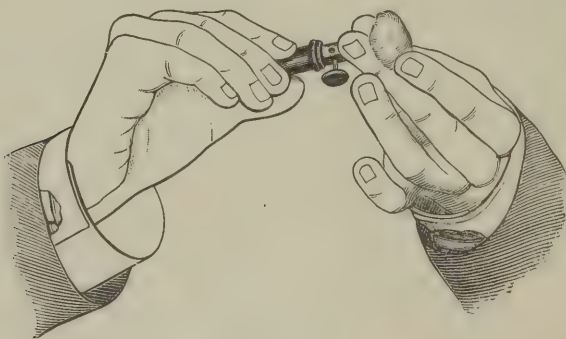


Fig. 14.—Applying absorbent cotton to electrode disk (second stage).

it has an advantage possessed by no other material in accuracy of contact, which practically broadens the path through the skin.

Current-diffusion Within the Body.—The subdermic body conducts currents with a reasonable ease because of its watery and saline

constituents. Grossly speaking, those parts that are most watery are, therefore, the chosen paths of transit through the body, a greater proportion of current going through the soft tissues around bones and nerves than will take the apparently shorter cut through them. Such considerations are important when we are compelled to depend upon interpolar action for therapeutic effect, and desire to send a dense current through a region beyond immediate contact with the electrode. Of still greater importance is a clear idea of current-diffusion in the body as a whole. To suppose that we can send a current through the body like a straight beam of light, or even in the belled cylinders depicted by Erb, is to ignore well-known laws of resistance and current-diffusion. The author pointed out some years ago¹ that a demonstration of the real facts of much importance to physicians is contained in Prof. W. G. Adams's experimental measurements of current-diffusion within masses of salt water.² Buckets and tubs of salt water and various acid solutions were used for experiments, the character of the solutions and the shapes of the utensils presenting conditions closely analogous to the human body. To illustrate the facts thus verified, I have drawn three diagrams (Figs. 15, 16, and 17) in which the behavior of a current traversing narrow and wide conductors is shown. The lines of flow are seen in each instance to cross the dotted lines at right angles. These dotted lines are lines of equal potential. Exactly what equipotential lines in electricity are can be best understood when it is known that they are analogous to the edges of the steps of a staircase down which a water-current is flowing. In this case it is assumed that the middle step is zero, or at the level of the earth (making it analogous to a staircase with the middle step at street-level, and each half of the remainder going upstairs and down cellar).

In the narrow conductor (Fig. 15) the equipotential lines, or, in illustrative language, the edges of these steps of electric level, extend straight across the conductor, the lines of flow being straight lines from pole to pole. In the wider conductor (Fig. 16) the lines of potential tend to curve somewhat about the poles; hence the lines of flow on either side of the centre one, which remains straight, curve a little also, as the potential lines must be crossed at right angles.

¹ *Journal Nervous and Mental Disease*, No. 7, 1886.

² *Proc. Royal Society*, vol. xxiv, p. 1. See, also, a theoretical discussion by Foster and Lodge, *Proc. Lond. Phys. Soc.*, vol. i, page 113.

When the current is passed through so large a conductor as the human body (Fig. 17), the potential lines becomes arcs of small circles about each pole, the size of the circles rapidly increasing as we proceed away from the poles. The lines of flow traverse every portion of the conductor as before, crossing the equipotential lines at right

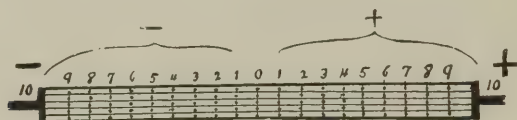


Fig. 15.—Diagram showing the distribution of a current of twenty volts within a narrow conductor. The milliamperes are equally distributed in the lines of flow (represented in the cut by horizontal lines). The lines of equal potential (represented by dotted lines) are drawn one volt apart, and have a value indicated by the figures.

angles, and differ in amount of current carried only in inverse ratio to their length.

It is necessary to add that these diagrams represent the distribution in an homogeneous conductor, such as a single organ, and that slight alterations would be required to make them represent accurately any composite conductor like the body. An accurate chart of the soft parts, nevertheless, would only add waviness to the lines as

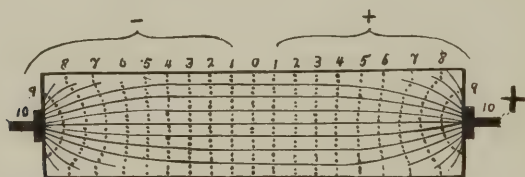


Fig. 16.—Distribution of a current of twenty volts within a wider conductor. The lines of flow on either side of the central one curve somewhat, as do also the most positive and most negative potentials.

drawn, though bones and bony cavities would deflect them greatly. It should also be remembered that the diagrams represent a section only, and that the equipotential lines are, in reality, cup-shaped planes through which the lines of flow spread in all directions.

Current-concentration.—It is the converse of these facts of current-diffusion within the body that it is difficult or impossible to bring a concentrated current to bear on organs or growths that are far beneath the surface, the nearest approach to concentration at a distance requiring a very heavy current at the polar contacts. Now, the effects are proportional to the concentration as well as to the strength of the current; that is, 10 milliampères will act with twice

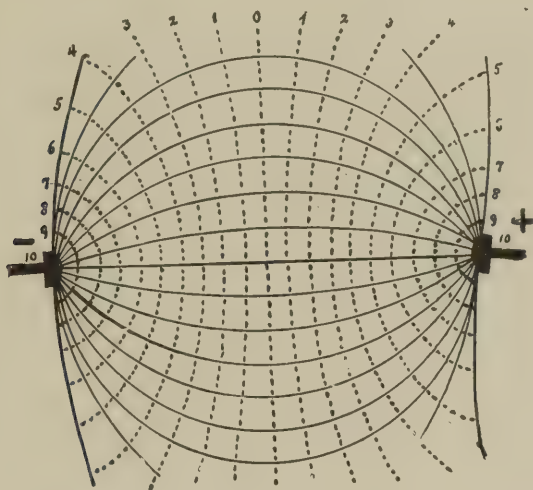


Fig. 17.—Distribution of a current of twenty volts within the human body. The equipotential lines or planes become segments of perfect circles, and the lines of flow, necessarily crossing the latter at right angles, become greatly curved and extend to all parts of the body in passing from pole to pole. The number of milliampères traversing the lines of flow differs somewhat, being inversely proportional to the length of the lines.

the strength on a surface of one centimetre that it will on two centimetres; hence the field of application of concentrated currents is far greater in what is called the polar regions, or in the immediate neighborhood of the poles, than in any other portion of the circuit.

It will be noted also, by a reference to the cuts, that in a large conductor such as the body the current will so spread out after entering it that it cannot be said to traverse a nerve or other structure beneath the pole in any special direction, since it traverses it, in fact,

in every direction. These considerations, together with important electrolytic and cataphoric actions at each pole, result in making a galvanic application practically an application to an organ of a certain polarity to a variable surface and depth.

At the surface itself the effects can be accurately gauged by a combination of the three elements of strength, duration, and concentration, the cauterant effects to be described later being particularly dependent on the polar concentration, which is determined, in applications to mucous surfaces, by the extent of the electrode left uncovered by insulation. With an intra-uterine electrode, for instance, having a bare surface extending two inches back from the point, 20 milliamperes may not cauterize in three minutes, but may cauterize slightly in five. Fifty milliamperes can be used with a bare electrode of greater size in the vagina under the same conditions, with about the same result. On the other hand, $\frac{1}{2}$ to 1 milliamperè, applied on the point of a fine needle, as in the epilation of hairs, will cauterize in a few seconds.

Polar Regions.—The area beneath each electrode, or around it if placed within the body, where the current-lines are densest and the polarity most positive or negative, is called the polar region, the intervening space being interpolar. Besides the results due to the usual concentration at the polar regions, certain chemic and vital effects noted below appear in these regions only, rendering them the most effective situations for electric application. Yet a diminishing polarization extends deeply into the body from a strong current, being *nil* only in the centre, and the lines of flow, though greatly dispersed at this depth, extend completely through the body. This intermediate region is called the interpolar region (Fig. 18).

Within the interpolar region the interstitial and cellular irritation incidental to the transmission of the current and of the particles that appear naked at the poles is the chief basis for therapeutic results, while in the polar regions the chemic action of these particles, as described below, is supplemented by another set of phenomena due to the behavior of nerves when under the influence of concentrated current at either pole. It is in the immediate vicinity of the poles, therefore, that the most direct therapeutic results are obtained, and the readiness with which electrodes may be brought in contact with diseased conditions within the pelvis is a most promising fact for the electro-therapeutics of gynecology, although, even in this class of dis-

eases, the interpolar action of the current must frequently be depended upon.

It is hardly necessary to mention here that no attention is paid to the direction of the current, as such, by modern therapeutists, who look only to the polarity of the active electrode. The older terms "ascending" and "descending" were incorrect in view of the fact that a current spreads in all directions beneath each pole; and the reactions formerly attributed to one or the other direction are now known

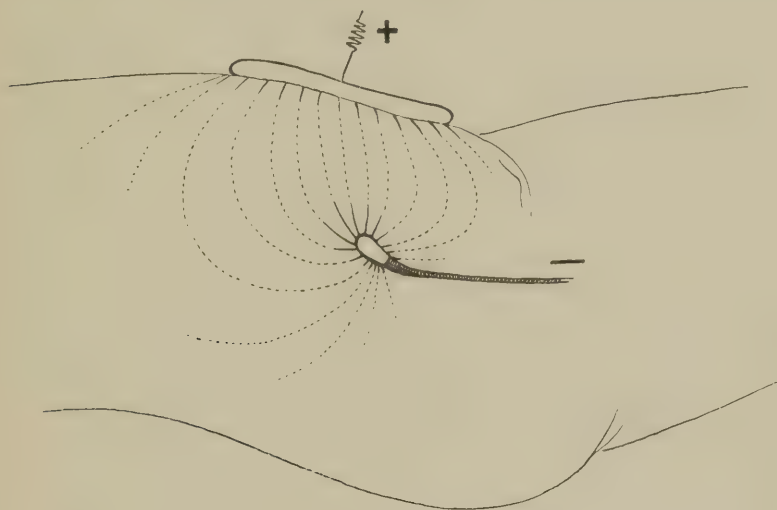


Fig. 18.—Diagram of polar and interpolar regions. The current lines are drawn full in the polar regions and dotted in the interpolar region. The active polar region, which is negative in the cut, extends in all directions around the electrode, but is widest on the aspect nearest to the indifferent pole.

to be due to the polarity. Even within the interpolar region the direction of the current has no known significance at present.

It should also be understood that the region of nerve-polarization about an active pole is somewhat larger than the region of chemic decomposition, and that we can readily include within it any nerve or nerves within, say, three-fourths of an inch of the electrode, when using currents of 20 or 30 milliamperes.

The Interpolar Region.—Since it follows, from the facts touched

upon in the foregoing paragraphs, that the chemically destructive action of a continuous current is limited to the close neighborhood of the electrodes, and the direct nerve-modifying action is also limited to a somewhat larger region in the same situation, the natural question arises: What can be therapeutically accomplished when the seat of disease is necessarily situated beyond the direct reach of the electrode? An answer drawn from both neurologic and gynecic experience is that much can be accomplished; and this is doubtless due, in the first place, to the influence upon nutrition of the chemic interchanges that occur throughout the circuit, in the onward progress of the particles that appear free finally at the poles (cataphoresis), to the influence upon nutrition of the circulatory changes that result from vasomotor stimulation, and to the contractions produced in unstriated muscular tissue by heavy currents, even at a distance.

These results of quiet current transmission are governed in magnitude at a given spot by the *density* of the current at that situation and by the *duration* of the application. The difficulty of carrying an effective density to a tumor, extravasation, or other morbid spot, situated at some distance from the active electrode, is indicated by a glance at Fig. 18, in which the spread of current is well represented by the direction and shading of the lines shown in the interpolar region.

To accomplish much in the more distant parts of this region considerable milliampère-strength must be employed; hence a delicate judgment is demanded in the selection of the size of the active pole to avoid cauterization, on the one hand, and too great a diffusion, on the other.

Electrolysis.—A current from a battery of cells is an instance of chemic energy converted into electric energy.¹ The correlation of forces in nature is evidenced by the fact that this electric energy may be reconverted into chemic energy when a current is made to traverse a watery solution of salts and other binary compounds, the compounds being decomposed into their ultimate elements by a process called "electrolysis." All liquids that conduct electricity, except mercury and melted metals, are thus decomposed by its passage through them, the accepted explanation being that, of any two atoms forming a

¹ Which is ultimately true also in dynamo-produced currents, in which the energy may be traced back to the chemic energy of the coal consumed.

binary compound, one is positive and the other negative, and that when an electric current is passed through the solution the electric affinity becomes superior to the chemic affinity¹ and tears them apart, the freed elements being called "anions" and "cations."

Water, though when absolutely pure a non-conductor of electricity, in its ordinary state contains sufficient saline impurities for conduction, and is then readily electrolyzed into its component atoms of oxygen and hydrogen, the oxygen becoming an anion and going to the positive pole, or anode, and the hydrogen, a cation, and appearing at the negative pole, or cathode (Fig. 19). At the point of contact of the positive electrode with the water the oxygen contained within the nearest molecules is torn from the hydrogen and attracted to the electrode; the freed hydrogen-atoms immediately attach themselves to

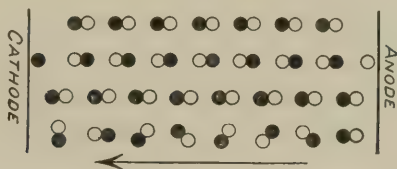


Fig. 19.—Diagram of electrolysis. The electro-positive radicle of each molecule is represented black, and becomes a cation when released at the cathode, or negative pole. The electro-negative radicles are drawn white, and become anions when released at the anode, or positive pole.

more distant oxygen-atoms, freeing other hydrogen-atoms nearer the negative pole, which repeat the process with the next molecules. In this way a chain, or series, of electric transferences occurs throughout the circuit, the last hydrogen-atom remaining free and attracted to the negative pole, to which it adheres. Thus a double process of actual and physical transference occurs in opposite directions, the amounts being equal and proportional to the milliamperes used, the electrolytic transference differing from cataphoric transference in that the latter may occur without chemic absorption of the propelled bodies at any portion of the circuit.

¹ Chemic affinity is now understood to be identical with electric affinity, the atoms of a binary compound being held together by the attraction of their opposite charges.

That the electrolytic combinations and recombinations in the interpolar portions of the circuit may exert profound effect on the metabolic activities of the tissues is certain, yet the most apparent physical effects are found in the immediate polar regions, both on account of the usual concentration of current in this situation and of the action of the freed anions and cations, which, being in their nascent condition, produce effects due to their union with the tissues. The polar effects are, therefore, peculiar to each pole and are of predominant therapeutic interest.

Chemic Effects at Each Pole.—Though, as has been said, the electrolysis extends throughout the electrolyte and occurs in any portion of it in proportion to the strength of the lines of flow that traverse that portion, the freed elements, anions and cations, appear only at the poles, or electrodes. In the body, constituted so largely of water and various salines in solution, the anions that appear at the positive pole are oxygen, chlorine, and the acids, and the cations at the negative pole are hydrogen and the bases. When released in sufficient quantity the caustic effects are characteristic at each pole, and have been specially applied to therapeutics by Tripier and Apostoli under the name of “galvano-chemic cauterization.”

Since the gynecic applications of electricity consist frequently of sufficient milliampères and concentration to produce these local effects, their exact nature invites close study. A careful naked-eye observation of the phenomena when a strong current is flowing is certainly both instructive and impressive, as well as decidedly conducive to the future welfare of the observer's patients. An experiment with fresh butchers' meat will give a very good illustration of the chemic part of these phenomena as they occur within the living body.

*Experiment 1.*¹—Procure a half-pound of beef-muscle; insert into it two ordinary steel needles, one connected with the positive pole and the other with the negative pole of a good battery, and pass through the meat from 100 to 200 milliampères for two minutes.

A sort of hissing or frying noise will be heard. This is seen to be caused by the rapid production and escape of small bubbles (of hydrogen-gas) from the track of the negative needle. The positive needle will cause no appreciable production of gas, but will imme-

¹ For further experiments with currents see page 312.

diately be found to be so firmly fixed in the tissues as to be withdrawable with difficulty.

On cutting down alongside the negative needle it is found to be practically surrounded by a cavity containing liquids and bubbles of hydrogen-gas. The muscular tissue has been destroyed wherever in contact with the needle, the edges of the cavity showing it softened, infiltrated, and of a darker color. The needle remains as bright as ever.

The positive needle, if left in place and cut down upon, shows itself greatly rusted and corroded, inclosed firmly in a grayish eschar, colored darker in places by the dissolved iron of the needle.

If the positive needle be of brass, copper, nickel, zinc, aluminum, or any of the other baser metals, it is corroded with varying rapidity, the tissues being stained by the particular metallic salts formed for some distance from the needle. On using a platinum needle for the positive pole, on the contrary, it is found to be practically unattacked by the nascent oxygen and acids. The tissues about the needle show now the uncomplicated picture of a positive electrolysis,—viz., the characteristic hardening and searing of an acid application. A slight cavity forms about the needle, though not so large as that about the negative needle, filled with bubbles of oxygen-gas which have failed to unite with the platinum, and the non-corrodible positive needle is therefore not so firmly fixed in the tissues as would happen with a baser metal. This refractoriness of platinum is shared in a lessened degree by gold and carbon, the former being corroded to a slight extent and the latter roughened slightly in time by mechanical disintegration. It is evident, therefore, that, *whenever the active pole of a strong, concentrated current is positive, it should consist of either platinum, gold, or carbon, unless we wish to employ cataphoric diffusion of the material of the electrode.*

The negative needle remains clean, whatever the metal of which it is composed or the strength of the current.

Reverting to the disintegrated cavities in the meat, produced by the negative and positive poles of a strong current (the positive pole having been non-corrodible), we can easily prove that the froth at the negative is alkaline, and that at the positive acid, by placing a drop of litmus solution upon each and allowing the current to continue a few moments. The blue color of the solution is unchanged at the negative pole, but is quickly reddened at the positive. By changing

the character of the pole back and forth while still *in situ*, several such changes of color can be produced. The peculiarities of the disintegrating action of each pole are largely due to the nascent alkalies of one and the nascent acids of the other. At the negative pole we have the soft liquefaction and infiltrated edges of an alkaline caustic; at the positive pole the hardened, coagulated eschar of an acid caustic.

Extent of Destruction at the Poles.—As to the extent of the destruction produced by a current,—a question of great interest in the treatment of tumors and other structures beyond the range of vision,—I have made the rough estimate that 200 milliampères, concentrated at the half-inch exposed end of a negative needle, will destroy an area of this length and a quarter of an inch in diameter in the muscular tissue of the cadaver, if passed through for two minutes. In a living carcinomatous tumor of the breast I have produced a necrotic area about two inches broad by one inch in depth by 1000 milliampères in ten minutes.

The amount of destruction produced by the same number of milliampères in different tissues varies, though, and it may be said to depend largely on the aqueous contents of the tissue, for the cavities produced in the experiments on meat were caused, to a large extent, by the destruction of water. Less decomposition will be attained by the same current in a fibroma than in a striated muscle, for this reason, and the disintegration depends more largely on the cauterizing effects of the liberated chemicals, though necrosis does not occur at this pole even with this current-strength if the electrode be of gold freely supplied with a coating of mercury for the oxygen and chlorine to attack.

Cataphoresis.—But there is another physical accompaniment of the transmission of galvanic currents through a liquid-containing conductor, such as the body, and that is the actual transfer of liquids and solids (in solution or in small particles) through it in the direction of the current. This is analogous to ordinary osmosis, but is entirely determined in direction and amount by the current. It is called cataphoresis, and, since medicaments can be inserted into the body by it, chiefly from the anode, or positive pole, it has also been termed “anodal diffusion” by Peterson, of New York, who has made a recent study of the subject. It may be demonstrated in physical apparatus by inserting an electrode each into two porous cups that have been filled to the same height with water and placed in a pan of water of

the same depth. After the current has passed for a time it will be noticed that the level of the water in the tube in which the positive pole has been placed is lower, while that in the negative tube is distinctly higher, showing an actual transfer of the liquid.

The same action is easily demonstrated in the living subject during the course of a vaginal application, such as will be described later, if the cotton covering of the vaginal electrode is not abundantly saturated with water before insertion. If it is made positive under such circumstances and 50 milliamperes turned on, it is extremely probable that the current will shortly decrease on account of actual drying of the layer of cotton in immediate contact with the metal, rendering the resistance greater in that situation. I have seen it decrease to 30 or 20 milliamperes in a few minutes, the moisture having been passed onward into the tissues. If now, before actual drying of the cotton has occurred, the current be turned off, the commutator changed to make the internal electrode negative, and the current again turned on, the ease with which the battery will supply 50 milliamperes will be in striking contrast to the difficulty when the active electrode was positive. In a few moments the returning moisture of the cotton will admonish us to turn the controller back, or more current will pass through than was desired. The desiccating effect of the positive pole is so great that when concentrated, as in puncture with a fine needle, it is often difficult to get sufficient current without increasing the electromotive force, while no such trouble occurs if the puncture is negative.

This desiccating action of the positive pole renders it of value in lessening congestion and checking hemorrhage, while the congesting effect of the negative pole renders assistance in impaired nutrition, in dilating orifices and canals, and in promoting flow or drainage.

It has been seen that the metal of which the positive pole is composed is a matter of importance, since, if not platinum or carbon, it is attacked by the nascent anions released in contact with it, particularly oxygen and chlorine. Iron, lead, zinc, brass, and copper are easily and deeply corroded in this way; tin, silver and aluminum less readily, but distinctly, acted upon; and even gold is roughened and its alloys oxidized after a time. Carbon resists any direct action apparently, yet a carbon electrode in continual use as a positive pole soon becomes roughened, apparently by a detachment of the looser particles on its surface, but possibly by the direct action

of the oxygen. Platinum alone, and its more rigid alloy with iridium, seems to be the only metal absolutely proof against the intense chemic activities concentrated at the positive pole of a strong current.

When one of the baser metals is placed within or in contact with the body as a positive pole an oxychloride is formed which, by an electrolytic cataphoresis, is transmitted through the body toward the opposite pole. That is, it unites with the tissues in immediate contact with the electrode surface, while being transmitted inward, if the electrode has no covering of clay or cotton, and by chemic action produces the characteristic effect of the nascent substance on flesh if the current is strong and sufficiently concentrated. Platinum and carbon anodes therefore enable us to produce, when the current is strong and concentrated, a caustic action due to nascent oxygen and chlorine alone, while the baser metallic anodes add the effect due to caustic salts of the metal employed, and their use also involves a cataphoric transmission of the metal into the body if no electrode covering is used. With or without an electrode covering, and whether concentrated or dispersed by varied sizes of electrodes, an amount of metal is always dissolved from the anode, or positive pole, of a base metal in exact proportion to the millicoulombs used.

Besides the depleting and congesting actions of the two poles already alluded to, it will be seen, therefore, that important use may be made of metallic cataphoresis, if desired, by using the metal as an uncovered anode. This subject has been elaborated by Gautier, Morton, Goelet, and Cleaves, and, in addition to the following description of the *modus operandi*, its application in special classes of cases will be dwelt upon in the chapters devoted to special therapeutics, particularly in the description of the author's new method for the treatment of cancer.

Mercuric Cataphoresis.—The cataphoric administration of mercury, which, so far as the author is aware, is original with him, is accomplished by amalgamating gold electrodes with this metal (*i.e.*, causing the mercury to adhere to the electrode surface by first dipping the latter into weak acid and then into mercury). Employed as a positive pole, the mercury disappears, together with probably a minute quantity of gold, being united to the atoms of oxygen and chlorine produced at this pole by the electrolytic decomposition of the tissues to form oxychlorides, which are diffused by the cataphoric process into the immediate neighborhood of the electrode along the

lines of current-flow. Before each subsequent application the mercury should be renewed, though a second freshening with acid may not be necessary.

The immense value of a process that enables us to diffuse mercury in atomic proportions directly into a diseased tissue is evident when we recall the well-known qualities of the metal when administered by the mouth, and realize that we have the additional advantage in this process of dealing with nascent salts of the metal,—a condition of chemic compounds in which their strongest qualities are evinced.

It is my belief, supported by facts detailed elsewhere, that this method will be of immense value in adding to the sorbefacient and alterative actions of electricity in chronic inflammatory conditions and their sequels, and, more important still, that in the massive infiltration of neoplasms, even of cancerous character, by the oxychlorides of lethal metals, we have the best method of destroying the essential principle on which their malignancy depends (see page 236).

An incidental advantage in employing mercuric cataphoresis instead of simple positive galvano-chemic cauterization in many intra-uterine applications is that the effect is less caustic, while probably of greater benefit, for the nascent oxygen and chlorine expend their energy on the mercury instead of on the surrounding flesh.

General Medicamental Cataphoresis.—The possibilities of the cataphoric method of administering remedial agents are very great and but slightly realized at present by the profession. Its chief value, of course, is when we either wish to administer the remedy to a certain locality accessible to, or in the near neighborhood of, an electrode, without diffusing it throughout the system, or when we wish to overwhelm a certain locality with the remedy in its nascent condition.

All active principles of medicines are capable of being so administered, the amount transmitted into the body being directly governed by the millicoulombs of current (see page 283), but it is important to carefully select the pole on which to place the remedy in accordance with its chemic nature. This is readily determined of those substances whose constitution we know, remembering that there is a double action going on: (1) a simple electric osmosis, always from the positive pole, by which salts and the water in which they are dissolved are transmitted inward toward the negative pole; and (2) an electrolytic double current, in which the molecules of the compounds are

broken up into their constituent atoms, the oxygen and acids going from the negative to the positive, and hydrogen, alkalies, and the bases going from the positive to the negative. This, of course, means that such substances as hydrochlorate of cocaine and the salts of other alkaloids should be placed on the positive pole, the active base being driven inward toward the negative pole and the useless hydrochloric acid adhering to the positive electrode. Conversely, if we wish to administer the arsenic in arsenite of potassium we recall that the arsenious acid is the active agent, and that it is repelled from the negative pole to the positive; the solution should therefore be placed on the negative pole.

As before said, certain amounts of diffusion of the salts occur as molecules of compounds in solution by simple electric osmosis, this being always from the positive pole.

Kohlrausch discovered that each atom has its own rate of motion in a given liquid, independently of what it may happen to have been combined with, hydrogen traveling faster than any other atom. Lodge¹ gives the subjoined table of the speed of atoms of the substances mentioned when urged by a potential of 1 volt per lineal centimetre of electrolyte. The rate of some substances of interest in this connection are unfortunately not included.

TABLE OF CATAPHORIC SPEED OF ATOMS AT ONE VOLT
PER CENTIMETRE.

Hydrogen.....	1.080	centimetres	per hour.
Potassium.....	0.205	centimetre	per hour.
Sodium	0.926	"	"
Lithium	0.094	"	"
Silver	0.166	"	"
Carbon	0.213	"	"
Iodine	0.216	"	"

Functional Stimulation and Sedation.—(a) *Indirect Stimulation and Sedation Through the Medium of Nerve-trunks.*—In addition to electrolysis and cataphoresis, which are effects practically obtainable only from galvanic or continuous currents of appreciable milliamperage, there remains to be considered another mode by which elec-

¹ "Modern Views of Electricity," Lodge, p. 87.

tricity may act upon the body, which may be called "functional stimulation," or "sedation."

In its indirect form, or the stimulation of organs through their afferent nerve-trunks, this mode of action has been the one most generally recognized in electro-therapeutics, many neurologists practically regarding it as the only action, though in real importance it is often overshadowed by electrolysis and cataphoresis. Closely connected with current-volume and concentration, and hence, peculiarly displayed by galvanic currents, it is, by virtue of its appearance at the instant of variation in slight currents of higher voltage, the only appreciable mode of action of faradic and franklinic currents.

When the special functions are indirectly stimulated through the nerves, both motor and sensory, the response, even in the galvanic, is limited mainly to the moment at which the variation occurs in the electric condition of the nerve. The functional stimulation thus produced occurs at increase or decrease of current at either pole, the response being proportional to the amount of variation and to its suddenness; in other words, an increased speed of variation will compensate for less current, and *vice versâ*. For speed of variation we may substitute height of pressure (which has been defined by some as synonymous with velocity), for it is also true that the greater the pressure, the less the milliamperage required to stimulate. An illustration of this may be found in the fact that the static induced current with several thousands of volts pressure and less than the millionth part of a milliampère of volume will contract a surface-muscle better than an insufficient dose of a galvanic current, even though it be several milliamperes. Though with weak currents nerve-stimulation is thus limited to the moment of varying, closing, or opening of the circuit, with strong currents the stimulation or sedation continues throughout the duration of the application, producing a continuous contraction or sensation. All current-variations are stimulant, though the continuous galvanic current is sedative at the positive pole, and very rapidly successive faradic currents of high voltage and minute ampèrage will act as an analgesic.

This excitation of function is supposed to be due to the sudden polarization or depolarization of the nervous molecules traversed by the current. It is always greatest when the nerve is under a concentrating electrode, and the action at each pole of the galvanic current differs in relative vigor, due to the fact that a condition of stimu-

lation occurs at the negative pole, or cathode, called "catelectrotonus," and one of sedation at the positive pole, or anode, called "anelectrotonus." These differences are of great value in pelvic applications and also give rise to the formulas of motor response so important in neurologic diagnosis.

Catelectrotonus.—If a nerve be subjected for a few moments to the action of the negative pole of a galvanic current placed in its immediate neighborhood, it has been demonstrated that its excitability to all stimuli is distinctly increased. This has not been adequately explained, but it is possible that the influx of fluids into the nerve due to cataphoric action is the chief cause.

Anelectrotonus.—A nerve similarly placed with respect to the positive pole has its irritability decreased. The desiccating effect of this pole would seem to explain this also.¹

(b) *Direct Organic Stimulation and Sedation.*—The stimulating and sedative effects of the galvanic current are by no means confined to the intermediate agency of the nerves. Muscular tissue of both the voluntary and involuntary kind itself responds to milliampère currents, and, though the demonstration of direct cellular stimulation is not so easy in other organs of the body, it is extremely probable that glandular and secretory organs and the general tissues of the body have a response to the continuous current independently of their innervating and trophic nerves, similar in kind to the skin responses (blanching and reddening) that are so readily observed by the eye. It is, particularly, this general tissue-stimulation that renders galvanic applications of greater value in gynecology than if they depended on muscular and nerve effects only, for we thus influence the multiform processes of tissue-metabolism, lymphatic activity, and nutritive repair, that are so important in correcting the conditions that are found in the pelvis after many acute or chronic inflammatory processes.

Bactericidal Action of Electricity.—The influence of the constant current on the vitality of microbes has been investigated by Schiel, Cohn, and Mendelssohn, and most recently and thoroughly by Apos-

¹The chief factors in the normal formula of motor responses is that the first response appears at the production of catelectrotonus, or cathodic closure (closure of circuit with negative pole over nerve), and the next at the return of a relatively cathodic condition (equal to disappearance of anelectrotonus) at anodic opening; hence the formula: K. Cl. C.^{'''}, A. O. C.^{'''}, A. Cl. C.^{''}, K. O. C.[']

toli and Laguerrière.¹ The latter observers made a most thorough study of the subject during a series of fifty-two experiments on the microbes of anthrax, pus, and various non-pathogenic varieties, in which 140 guinea-pigs, 42 rabbits, and 2 dogs were killed.

The apparatus found best adapted to the determination of the action of each pole is shown in Fig. 20, by the use of which it was possible not only to isolate the action of each pole in its tube, but also to test the interpolar effect adjacent to each pole. As was to be expected, the passage of strong currents from the surface of small platinum spirals through the peptonized broth used caused a decided rise of temperature, particularly at the positive pole. In some of the experiments this thermal influence was eliminated by placing the

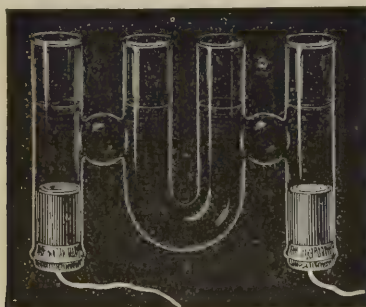


Fig. 20.—Apparatus employed by Apostoli for testing the bactericidal action of electricity.

apparatus on ice. In others the chemicals liberated at each pole were eliminated, either by the use of an absorbent, such as magnesium or lead, at the positive pole, or by being covered with a vegetable mucilaginous material called gelosin. The results showed a distinct attenuation or destruction of the microbes when currents of more than 50 milliampères were used for five minutes. Beneath that dosage the action of the positive pole actually increased the virulence of the microbes, doubtless by reason of the addition of free oxygen to the media and a moderate increase of temperature. It was further proven

¹ "De l'Influence du Courant Continu sur les Microbes." Par MM. Apostoli et Laguerrière. Reprint, Paris, 1891.

that neither the negative pole nor the transmitted current through the interpolar region exerted any influence on the vigor of cultures, and that the action of the positive pole was entirely dependent on the nascent chemic products and the heat that were developed.

These carefully-conducted experiments must certainly discourage the use of galvanic applications as germicides, *per se*, within the body-cavities,¹ since current-strengths entirely sufficient to cure certain post-infective cases do not develop that quality; but in this disappointment we only follow the experience of antiseptic therapeutics as a whole in these cases. They prove, nevertheless, that, where currents exceeding 50 milliamperes, concentrated, are called for in their curative capacity, we may also anticipate a direct microbicidal action accompanying them. It need not be said that this is a great comfort in electro-surgery and that in the ampèrages used in cancer, for instance (400 to 1000 milliamperes), we also employ a most efficient and thorough antiseptic application. For antiseptic action in currents under 50 milliamperes we must rely upon antiseptic cataphoresis, in which it is possible that minute currents may be made efficient by surrounding the active pole with a cotton covering holding antiseptic solutions, or by using an amalgamated anode.

The Alternative Action of Electricity.—Whatever conclusions are arrived at relative to the bactericidal action of electricity, it should not be forgotten that the cure of the latter stages of affections of bacterial origin necessitates an alteration of abnormal nutritive processes which have resulted from the bacterio-phagocytic contest. Nature must be stimulated and assisted in the removal of this proliferated material; hence the administration of electricity for quickening cellular metabolism should be arranged for in such cases. The negative pole of the galvanic current is indicated for this purpose.

Indications for Choice of Poles.—The determination of which galvanic pole to use in gynecic practice will be specially considered in connection with each affection, but it is rare that the result of experience contravenes certain guiding-principles derived from the facts contained in the foregoing paragraphs. From them it is apparent that the reasons governing choice are chemic, cataphoric, and elec-

¹Except in connection with mercuric or other antiseptic cataphoresis, which acts freely and immediately, one application sufficing to aseptinize the worst ulcer.

trotonic. The positive pole is therefore microbicidal, capable of diffusing medicaments, drying, depleting, hemostatic, and sedative. The negative pole is congesting and therefore a quickener of absorption, increases moisture and drainage, dilates canals, produces most destruction in electrolytic concentration, and is most stimulant.

Interrupted Galvanic Currents in Gynecology.—Galvanic interruptions, either rapidly or slowly produced, are rarely, if ever, used in direct pelvic applications, for the reason that they are far more productive of pain and shock than faradic currents and are in no wise more effective than the latter.¹ The avoidance of sudden current-variation, indeed, is a most important detail in the majority of applications of this sort, and it is for this reason that the author has insisted on the gradually increasing and decreasing method in this work.

Differences Between the Currents Used in Medicine.—What has been considered in the preceding pages as the galvanic current is the medical designation of the simple, direct current of electric energy, which would require no special designation were it not that we use other forms of electric currents in medicine that differ greatly in qualities and effects. The galvanic, faradic, sinusoidal, and franklinic currents are widely different remedies in practice, though they are all electric currents and convertible into each other by varying the mode of construction or operation of the generators that produce them; that is, it is possible to do so, though usually inconvenient. The Edison current-dynamo is, however, practically a faradic machine so constructed as to give a galvanic current.

The real differences in these currents depend on the proportions of pressure and volume they possess, and whether they are direct or alternating, continuously flowing or a discontinuous series of inductions. Galvanic currents have a pressure varying from a few volts when a few cells are used to 100 or 110 volts or more, and a volume varying from 1 to 500 milliamperes or more, and are direct and continuous unless specially interrupted. Faradic and sinusoidal currents are said to have a pressure of about 100 to 300 volts, according to the coil and core used, and a volume of a small fraction of a milliamperè (probably from $\frac{1}{10}$ to $\frac{1}{1000}$ of a milliamperè). They are discon-

¹This statement by no means applies to the neurologic applications of electric currents.

tinuous and usually alternating, and each current-throb is of extremely short duration. Franklinic, or static, currents have a pressure of 60,000 volts or more, but the volume is probably below the millionth part of a milliampère.



PLATE I.—Arrangement of Examining Chair and Apparatus.



PLATE II —Arrangement of Applying Couch and Apparatus.

CHAPTER V.

TYPICAL METHODS OF APPLYING ELECTRIC CURRENTS IN THE DISEASES OF WOMEN.

WHATEVER form of apparatus is selected for the application of electricity in both the medical and surgical diseases of women, it should invariably include a controller through which both the faradic and galvanic currents must pass before reaching the patient, since none of these applications necessitate the use of shocks of any kind, and sudden accidental variations of the current should be rendered impossible. It must also invariably include a reliable meter through which the galvanic current must always pass while traversing the patient.

It is well to fix upon some definite relative arrangement of the operating-chair or couch and the apparatus. The author, having educated the left index finger for the gynecic touch in the early years of his practice, at the suggestion of the late Dr. Goodell, employs this hand particularly for the examinations and the manipulation of electrodes, leaving the right hand for the management of the controller, switches, etc. The relative arrangement of the chair or couch when the work of each hand is similarly determined is shown in Plates I and II.

The chair or table should be used in making diagnostic examinations and in all intra-uterine applications. The couch is essential in general, spinal, and most other applications, and may be used for vaginal applications, at times, by the acquirement of special skill.

The typical methods of applying electricity in both general and local affections of women may be described as follows, with the preliminary statement that the active electrode (the one placed nearest the diseased point) is invariably placed in position before the current is turned on, the controller-handle being carefully placed at zero, or the starting-point, and that the current is turned off before this electrode is removed, avoiding shocks of every kind.

General Galvanic Stimulation.—In the application of this

method the patient disrobes and lies on a couch on which a sheet or blanket has been so placed that both ends can be folded over the person. On this and beneath the back a large dispersing electrode is placed (page 309), connected with the positive pole of a galvanic current. To the negative cord is attached a round active pad, moist and well soaped, preferably with Ivory soap. Beginning with the arm (Plate III), the pad is held in contact with it and the current turned on at the controller, after which the pad is passed to and fro over the nerve-points of each group of muscles, taking care to act only on groups associated in action at one time. For instance, all the extensors of the hand can be easily moved by stroking the anterior aspect of the forearm, and the flexors by stroking the posterior. The pad is slipped from one side to another without breaking contact, and the whole arm can thus be successively thrown into action without turning the current off. On finishing the arm at the shoulder the current is turned off, the pad removed, and the arm dried.

The same procedures are enacted with the other arm and each leg (Plate IV), after which the pad, freshly moistened and soaped, is applied to the abdomen, and circular movements made in the direction of the colon (Plate V). It is almost always wise to apply a primary faradic current in this exact manner, through the controller, to the abdominal organs either before or after the galvanic application to the same parts (Plate VI).

The patient may then turn over, with the indifferent pad under the abdomen, and the galvanic current is applied to the back and flanks with slow movements (Plate VII).

The current-strengths employed in this method vary with the part of the body and the amount of adipose tissue covering the nerve-points, fleshy persons requiring more current. Usually from 15 to 20 milliamperes will do for the arms, 30 to 35 for the legs and thighs, and from 50 to 100 for the abdomen and back. The nerve-points for motor stimulation of value in these applications are shown in Plates VIII and IX.

This application is probably the most powerful stimulus to be found in general electric applications. In weak and nervous people it is apt to be followed by a short period of vascular depression and cold extremities preceding the reaction, but as strength is gained the warm reaction is more immediately realized. The method will usually be found to be preferable to faradic stimulation in the class



PLATE III.—Application to Arm, General Galvanic Stimulation.



PLATE IV.—Application to Leg, General Galvanic Stimulation.



PLATE V.—Application to Abdomen, General Galvanic Stimulation.



PLATE VI.—Stable Faradic Application to Abdomen, General Galvanic Stimulation.



PLATE VII.—Dorso-abdominal Application, General Galvanic Stimulation.



PLATE VIII.—Motor Points of Anterior Portion of Body.

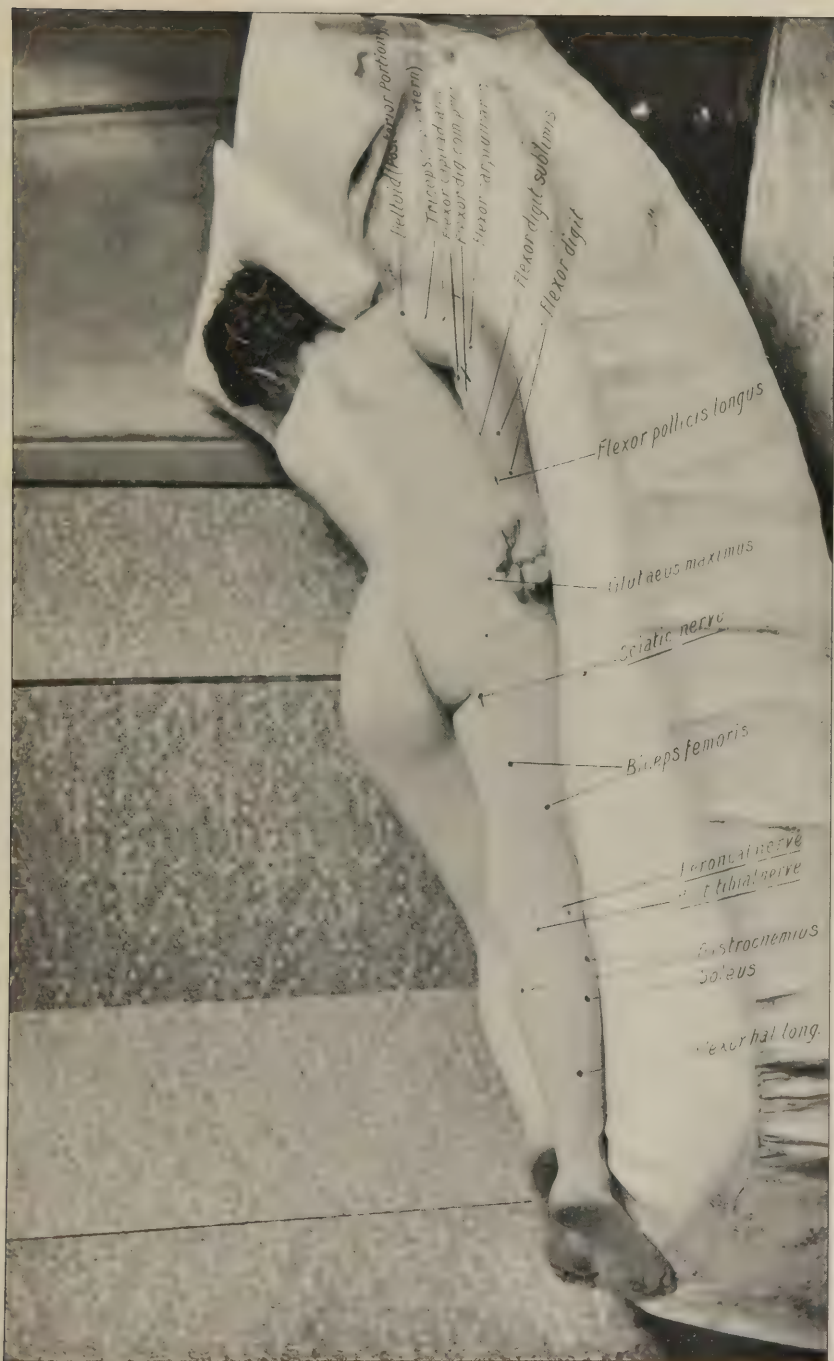


PLATE IX—Motor Points of Posterior Portion of Body.

of cases usually placed on the rest cure, and may also be used alone in cases of neurasthenia which are not suitable for, or will not submit to, isolation and rest, the strong currents transmitted through the abdominal viscera being particularly valuable in arousing dormant abdominal nervous forces so commonly deranged in these cases.

General Faradic Stimulation.—The patient being placed as described in previous paragraphs, the coil to be used selected and put into operation and the large pad adjusted to the back, the applications are made to the limbs and abdomen in the same manner as with the galvanic current, the controller being used to regulate the current-strength to the amount required to contract the several groups of muscles. As with the galvanic current, it is not wise to use more than needed to obtain a full motor response, since additional current will only give unnecessary pain. This monopolar method is quite essential to a proper faradic stimulation of the abdomen, but in the case of the limbs the Duchenne, or bipolar, method is somewhat preferable at times, producing a more local contraction of each group. In this bipolar method the two ordinary disk electrodes may be held in the same hand, the negative applied to the nerve-point and the positive near it on the belly of the muscle.

Abdomino-Dorsal Applications.—The patient lies on the back as in the preceding applications, with a large pad under the dorsal or lumbar regions, the clothing being removed from the field of application and protected from wetting by folded towels. Making sure that all current is turned off at the controller, the active electrode, the medium-sized round cotton pad, well moistened and soaped, is next placed on the abdominal surface. The current, whether galvanic, faradic, sinusoidal, or combined, is then turned on until the desired strength is obtained and the pad slid around in the direction of the colon.

The large electrodes and the perfect contact assured by the soapy lather enable a considerable density of current to be carried into the abdomen, since we can readily use from 60 to 100 milliampères, and it is not only an effective way of impressing the nerve and muscular structures of the pelvis and abdomen, but, by an upward extension of the field, we are enabled to act favorably on the stomach, liver, and possibly other digestive organs.

Spinal Applications.—The transmission of continuous currents through the spinal cord, so useful in many neuroses in which symp-

toms referred to the spinal region exist, is also of signal value in the amenorrhea and dysmenorrhea of young girls, requiring no concurrent medication if anemia does not co-exist. The patient sits sideways in a chair with the clothing loosened at the back, and two spinal electrodes are used (about two and a half by five inches), the positive being placed immovably on the lumbar region, and the negative held in contact with the cervical and various parts of the median and dorsal regions, in turn, giving a *stabile*, or stationary, current in each region of a minute's duration. From 10 to 70 milliampères may be used, in accordance with the patient's endurance. The faradic current is not used in this manner, as it would doubtless fail to act on the cord or deep-seated nerve-roots.

A more effective application than this is simply the reverse of the abdomino-dorsal application, the patient lying face downward with a large pad under the abdomen (Plate VII). The round pad is thoroughly soaped and passed up and down the back, employing 20 to 40 milliampères on the cervical and upper dorsal regions and 40 to 60 on the lower dorsal and lumbar regions; these figures may all be greatly exceeded in proper cases.

Vaginal Galvanic Applications.—All the galvanic applications usually made to the vagina are for the purpose of bringing organs situated beyond it or the general pelvic contents under an inter-polar influence (page 37). They are all necessarily monopolar therefore, one electrode, the active pole, being within the vagina and the inactive pole, in the shape of a large pad, either on the abdominal surface or beneath the back. If the active electrode can be pressed behind the exudation or enlarged organ, as is usually the case, the indifferent pad may be on the abdomen, otherwise it should be on the back, these dispositions of the electrodes being best designed to include the seat of disease within the tract of densest current-lines between the electrodes (see "Current-diffusion," page 32).

Contrary to the conclusions expressed in previous editions of this work, it should be said that the conducting-surfaces of all vaginal galvanic electrodes should be properly covered to protect the vaginal mucous membrane from irritation, particularly if the positive pole is used, and irrespective of the metal of which the electrode is made. This rule applies more generally to vaginal applications than to uterine, because it is not usually the case that the vaginal application is designed for the vagina itself, but for the structures beyond, the

covering permitting more current to be used without cauterization (page 31). The relatively large size of a bare vaginal electrode lessens this cauterization itself, as was stated in previous editions, but does not entirely obviate it.

A large experience in this form of application has convinced me that the best and most convenient covering for this electrode is absorbent cotton wound about the conducting-surface until a ball of proper shape and size is obtained, the covered electrode being then dipped in warm water until thoroughly soaked and then lubricated with a non-irritant soap. The cotton is, of course, detached and thrown away after each application, permitting the electrode (Fig. 21) to be thoroughly cleansed and aseptized. Dr. Goelet has introduced a clay-ball electrode designed to secure a contact-surface of clay

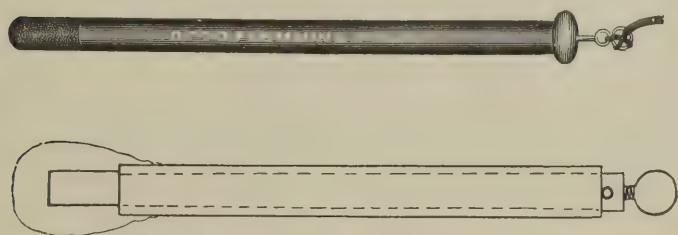


Fig. 21.—Author's cotton-covered vaginal electrode. The upper instrument is made of carbon. The lower one is a Leclanche zinc, covered with a piece of rubber tubing.

within the vagina, but the author can see no advantage in the use of this substance to compensate for its inconvenience as compared with thoroughly moistened and soaped absorbent cotton.

The soaped electrode may be easily inserted without the use of a speculum, the patient being usually in the dorsal gynecic position. If the seat of mischief is mainly in the posterior *cul-de-sac*, it is inserted there, tilted forward somewhat, away from the rectal nerves; if in the right or left ovarian region, it is placed in the right or left fornix. The indifferent pad may be the round pad described on page 309, the large cotton pad, or the Apostoli clay pad.

The active electrode is not inserted until the battery is found to be in readiness, the indifferent pad adjusted, and a glance at the

connections and controller shows the latter to be resting at the starting-point.

The duration of a vaginal galvanic application may vary from five to ten minutes, rarely longer with strong currents if the application be daily. It should be repeated at least thrice weekly. The current-strength used by the author varies from 40 to 150 milliampères, usually about 50.

The choice of pole is not a matter of indifference, proving that the application is not altogether interpolar, as clinical experience shows a distinct advantage in the use of the positive pole in conditions of pelvic inflammation or exudation approaching acuteness, while the negative pole causes greater congestion and quickening of the absorptive processes.

Vaginal Faradic Applications.—(a) *Monopolar.*—The technique of monopolar faradic applications to the vagina is exactly similar to the galvanic application just described, except that the electrode surface may be smaller and may be either covered or bare as most convenient, the natural moisture of the vagina being sufficient for the conducting-joint between the electrode and the mucous membrane. Much has been written concerning the advantages of certain positions of the internal electrode, a subject that will be discussed in connection with the treatment of displacements. If the purpose of the application is the cure of relaxation of the muscular structures, including the uterus, the primary current turned on through the controller should be used, of a strength short of the production of pain. If, on the contrary, the purpose be to overcome pain, whether due to congestion or to neuralgic conditions, the secondary is best.

(b) *Bipolar.*—Under the lead of Tripier and Apostoli much attention has been directed to the employment of bipolar faradic applications to both the vagina and uterus, Tripier having been chiefly interested in developing the value of the current of quantity and Apostoli that of a high electromotive force (page 324). There are no clear relative indications governing a choice between the monopolar and bipolar applications, some physicians resorting almost exclusively to one method and some to the other; but it is clear to the author that the bipolar method is always most effective in the control of pain. For this purpose the longest and finest wire is usually preferable, even if the patient asserts that she feels nothing. I say usually preferable, for the control of pelvic pain by the use of high-pressure cur-

rents is yet an empirical study, albeit in the main successful, for we must meet the varying conditions therapeutically on which pain depends. It has appeared to the writer that when the pain is due to relaxation of the muscular parts that a bipolar application of a moderately contractile current, such as that from the medium Goelet coil, is best, and this is, perhaps, due to the current setting in motion waves of contraction in unstriated muscular fibres, resulting in added tone. When the pain is more truly neuralgic in character, on the other hand, the mere analgesic effects of the longest coils of No. 36 wire is best.

When the electrode has been inserted and the current turned on at the controller the electrode should be held immovably in place, as any movement during the application will be a disturbance of the effect. Dr. Goelet's modification of Apostoli's instrument (Fig. 22) has distinct advantages in the ease with which immobility is maintained after placement, as it is lighter in the handle, and by its shape



Fig. 22.—Goelet's bipolar vaginal electrode.

is in some cases self-retaining. The whole current from the coil used can generally be employed, and the duration of the application may be from four to ten minutes or longer. It should be administered daily if practicable.

Intra-uterine Galvanic Applications.—Apostoli, to whose labors are due the establishment of monopolar intra-uterine applications of the galvanic current as a scientific procedure, invariably designates them “galvano-chemic cauterizations.” Such they always are if the active electrode is bare and the current sufficient to cauterize when so concentrated; but if the conducting-surface of the intra-uterine electrode is covered with moist cotton, as is frequently done by the author, a modified cauterization will result, unless the current be very strong or its duration prolonged. A distinction should therefore be considered to exist between a mere galvanic application and a galvano-chemic cauterization.

A most marked difference exists in the nature of these appli-

cations in accordance with the pole employed, as fully described at page 40. If simple positive cauterization is required, it is essential that the exposed surface of the active electrode should be either of platinum or carbon. Should any decomposable metal—such as copper, silver, zinc, or iron—be employed at the positive pole, a cataphoric application results, adding important additional features to the results, which may be advantageous or detrimental, according to circumstances (page 44). When the active electrode is negative, it does not matter of what the electrode is composed.

Instruments.—For the intra-uterine electrode Apostoli and some operators in this country use a sound capable of being covered at will by a sheath, made of either glass or hard rubber, or, as specially commended by the former, of celluloid, which is said to be less absorbent than the rubber (Fig. 23). These sheaths are extended backward into handles, through the whole of which the sound slides, and to which it



Fig. 23.—Apostoli's intra-uterine electrode. The electrode (A) slides in the handle (D) and is of platinum. At C is shown a movable covering-tube of hard rubber or glass.

may be rigidly connected at will by a screw. In my own practice I have found that this arrangement presented certain disadvantages. It is difficult to render the interior of the tube aseptic, and the best antiseptic—the flame of an alcohol-lamp—cannot be applied to the exterior of the rubber and celluloid sheaths, owing to their inflammable nature. In most cases, moreover, the insulating cover should be extended beyond the bend of the sound, in order that the cervix may be protected from unnecessary cauterization and the current-action confined to the interior of the corpus alone. This is impossible if the sheath is made of a rigid material, and, were it possible, the abrupt increase of calibre at the end of the cover would render the proper introduction of the sound impossible in many cases.

An exceedingly handy way to insulate a sound to any extent found desirable in a given case, after the proper curve has been given to it, and at the same time to thoroughly sterilize it, is to heat it to a considerable temperature in the flame of an alcohol-lamp or Bunsen

burner, and melt upon it a sufficient coating of pure gum-shellac. This forms a smooth, highly-insulating covering that adheres tightly to the sound and shades off in thickness at the bare end so gradually as to readily admit a passage wherever desired. The fusibility of the shellac without burning is its greatest advantage over the best quality of sealing-wax, but the latter may, however, be substituted for it if the shellac is not readily obtained. In covering the hot sound at first the coating retained by it is too thin for safe reliance, and it should be made heavier after cooling by attaching additional quantities of melted gum-shellac to it, the whole being then reduced to a uniform thickness by gentle fusing.

This procedure is only adapted to a rigid-shanked sound, though the curved portion may be flexible, for after the parts are once covered there should be no danger of the covered portion bending, as the material breaks easily, giving rise to leaks when in use. This dis-

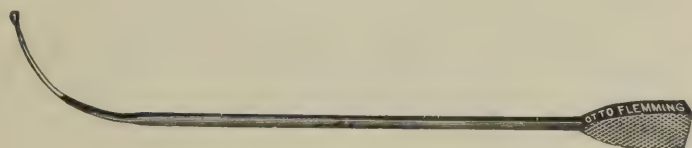


Fig. 24.—Author's sound-shaped platinum intra-uterine electrode, with fusible covering of shellac.

advantage is, however, more apparent than real, for nothing is more trying in this work than an attempt to employ one of the flexible-shanked electrodes made by some manufacturers, who erroneously insist upon making the curved portion rigid and the shank flexible.

Fig. 24 represents the electrode usually employed by the author, for whom it was made by Flemming. It bears a general resemblance to the Simpson sound, with a hard-rubber handle of the usual flat shape for indicating its position *in uteri*, and the addition of a socket for the attachment of the conducting-cord. The two and a half inches which may be left bare at the extremity are made of platinum, to adapt it for use as a positive pole. The covering should be made to reach the platinum always, and it is generally best to protect the os and cervix by carrying it to a point which will protect these parts when the instrument is inserted.

Before each application, and after the desired curve has been

imparted to the end, this electrode should be sterilized and any accidental breaks closed by a thorough heating of the bare part and fusing of the first two or three inches of the covering.

But, whenever it can be inserted, the best intra-uterine electrode for all non-cataphoric applications is the author's spiral platinum electrode (Fig. 25), which conforms itself so accurately to the cavity as to be capable of insertion at times without being felt by the patient. Its painlessness and self-conformability even enable us to successfully employ intra-uterine applications at times when the uterus is fixed by subacute inflammations of the peritoneum or adnexa. Owing to these advantages, the author always selects it in preference to the stiff, covered electrode, unless the cavity is so tortuous or contracted as to demand the rigid instrument. If the uterus is sufficiently patulous and it is desirable to modify the local effect, it may be covered by twisting a light layer of absorbent cotton about the exposed portion as an applicator is covered, the cotton being then soaked in warm water



Fig. 25.—Author's spiral elastic intra-uterine electrode of platinum.

and soaped, or moistened with an antiseptic solution. When properly applied it is impossible to lose the cotton within the uterus, and, in fact, it must be burnt off after use, as the spiral will be injured by much traction on it; the burning, however, though troublesome, is always necessary for cleansing purposes. The shank of this instrument is best insulated with shellac or sealing-wax, as described, the material being carried down over the joint between the platinum and brass, permitting the whole instrument to be more thoroughly aseptized than would be possible with a movable or other cylindrical covering. The instrument was suggested originally on the lines of electrodes devised by Drs. Franklin Martin and A. H. Buckmaster, which consist of platinum wire wound about bougies, but these had the disadvantage of being capable of less thorough asepsis. An experience of nine years has convinced me of its great usefulness.

In endometritis, accompanied by hemorrhages, and in incipient cancer of the cervix, I have recently employed zinc-amalgam cataphoresis with one of the electrodes shown in Fig. 26 in preference

to either platinum or carbon electrodes. They are also best insulated with shellac to preserve the joint between the shank and olive. Before use they should be cleansed by heating and then freely amalgamated by being dipped into amalgamating solution or battery solution and then into mercury. The result is a bright, smooth surface that is practically lubricated by the mercury, rendering insertion easy; and as the mercury coating is the metal acted on when it is used as anode, the electrode will not adhere to the surface even after a strong current has been used.

It is, as a rule, far easier to insert all intra-uterine electrodes by touch without a speculum, as advised by Apostoli, the position of the

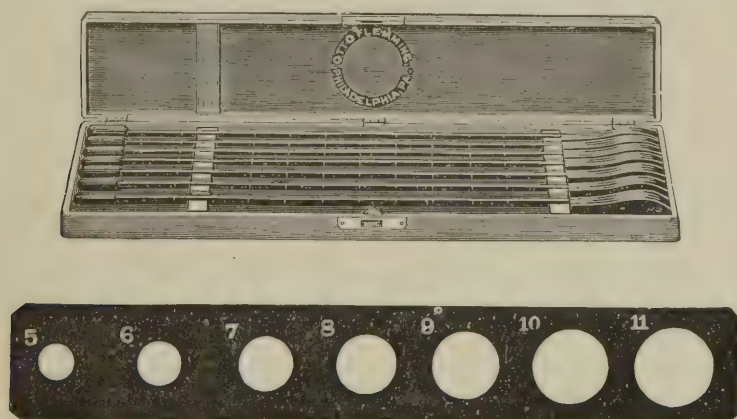


Fig. 26.—Set of zinc intra-uterine electrodes for mercuric cataphoresis.

uterus previously ascertained by the bimanual touch being thus more readily followed than if sight is depended on (see Fig. 8).

The indifferent electrode may be either the large or small pad described on page 309, or, if the current is to be strong, a freshly-made clay pad.

Position.—The dorsal position on a gynecic chair or table is the preferable one for this application, though the patient may lie across a firm bed with the feet on chairs or on the operator's knees, or may lie lengthwise in bed if the insertion is easy and the local conditions are familiar to the operator.

Preliminary Details.—Apostoli and most authors advise anti-

septic flushing of the vagina immediately before each application, but the author has long since given up this tedious and often unpleasant procedure, relying altogether on a fire-cleansed instrument and scrupulous cleanliness of the finger in addition to the daily douche enjoined on some patients, and in many thousands of such applications has never encountered sepsis. The natural secretions of the vagina are in some cases an assistance to a painless insertion, acting as a vaginal lubricant.

Before inserting the instrument the proper working of the battery, soundness of conducting-cords, and proper position of the switches should be ascertained, and, if no assistant is at hand, the indifferent pad should be first placed in position.

The Current- strength and duration.—As the conditions in which intra-uterine galvano-chemic cauterizations are advisable vary from a slight, but persistent, endometritis of an otherwise normal uterus to the most extreme case of uterine hypertrophy, hemorrhage, or abnormal growths, so the efficient dosage varies through an even greater gamut of change, additionally influenced, as it is, by the individual idiosyncrasy as to pain. Where the hypertrophy is great, and especially where the uterus participates in the growth and abnormalities of an intramural tumor, the strength may be as much as 150 to 200 milliampères, as it is pretty clearly established that the total effect depends more on the number of milliampères in circuit than upon the duration of the application. It is true, of course, that the actual amount of electrolysis produced by, say, 200 milliampères in five minutes can be secured by 50 milliampères in twenty minutes; but the effect in the latter case would differ nevertheless, for it would be entirely lacking in a powerful action within the interpolar region, which is depended on to influence the contractile tissue not directly affected by the cauterization. It should be remembered also that mere electrolysis does not describe the action obtained, and that the *caustic* effect of slowly-liberated chemicals does not compare with that of a liberation *en masse*. Currents exceeding 50 milliampères are, however, to be reached only after the tentative use of weaker currents.

On the other hand, slight cases of subacute or chronic endometritis, unaccompanied by hyperplasia, may be effectively treated and quickly cured by applications of 20 or 30 milliampères for five minutes, and, such being the case, it is manifestly improper to subject the patient to a more heroic treatment. In cases of hysteric or neuralgic

pain, in which it is thought wise to use intra-uterine galvanic applications, an even greater circumspection should be used, for cauterizations should be gauged primarily to the amount of organic disease present.

It is a safe rule, therefore, to gauge the dose to the amount of organic change within the uterus or in tumors closely attached to it, subject to modification at any moment on the appearance of pain.

As to the duration of an application not interrupted by the appearance of pain, I have every reason to commend Apostoli's rule of five minutes as an average application, though I frequently maintain it but four minutes. Given a large hypertrophy or tumor and easy tolerance of the current, it is better to extend the current increase rather than its duration, as there is less risk of producing breaks in the cuticle of the abdomen and the resultant burns.

Minor Details of the Application.—1. The patient's clothing should be sufficiently removed at the waist to render it easy to apply the indifferent pad without wetting or soiling it.

2. If there are any abrasions or pimples on the abdominal surface, they should be covered with pieces of paper smeared with vaselin, or in some similar manner, before the indifferent pad is applied.

3. The insulation of the active electrode should always be examined for imperfections before insertion.

4. Glance at the controller to make sure that no current is on before inserting the active electrode.

5. Pain may be relieved by only a slight reduction of the current.

6. Both patient and instruments should remain motionless during the application, to prevent accidental disarrangement of the apparatus.

7. The patient should be warned that she may have colicky pains within six hours after treatment, followed by soreness the following day, and that the leucorrhœa may be temporarily increased.

After the Application.—It is usually best to have the patient rest awhile before going home, but if a means of conveyance is handy this will not be necessary. In every case, however, where at least a hundred milliamperes have been used, she should lie down after reaching home and remain inactive during the remainder of the day. It is well to tell her plainly that a neglect of this precaution may cause serious congestion, entailing much discomfort.

Contra-indications.—The intra-uterine electrode should, of

course, not be inserted either as a sound or electrode at any time during pregnancy, and the physician is wise to make inquiry as to the regularity of the periods in every case before inserting it. Certain patients will too gladly refrain from enlightening him if they can do so.

It should not be inserted during acute inflammations of the uterus or the adnexa, though an elastic, cotton-covered instrument may be safely employed with mild currents within the cavity in sub-acute salpingitis after a course of vaginal applications. The question of employing intra-uterine applications as a diagnostic and a therapeutic agent in these conditions will be found discussed elsewhere.

Finally, intra-uterine applications should never be made for neu-



Fig. 27.—Apostoli bipolar intra-uterine electrode with fusible, aseptized covering.

ralgia or general conditions of any character, being reserved strictly for cases involving organic changes in the uterus itself.

Intra-uterine Faradic Applications.—It is quite customary in the writer's practice to turn on either a primary or secondary faradic current, monopolar, after a galvanic application to the uterine cavity, for its contracting or sedative effect, though it is rare that an instrument is inserted into the uterus for the faradic current alone except in early cases of subinvolution. When inserted for this current alone it is preferably bipolar, the Apostoli instrument (Fig. 27) having been so modified by Flemming, at my request, as to permit it to be aseptized in the flame. This is done by substituting fused hard rubber and shellac for the tubing usually on these instruments. The indications and choice of coils are discussed elsewhere (page 318).

CHAPTER VI.

ADDITIONAL SYSTEMATIC METHODS IN GYNECIC PRACTICE.

WHILE the author believes that in the rational and thorough application of electricity the physician has the most potent means of combating a large proportion of the chronic organic and functional diseases of women for the reasons given elsewhere, he by no means underestimates the remedial value of a number of other methods of

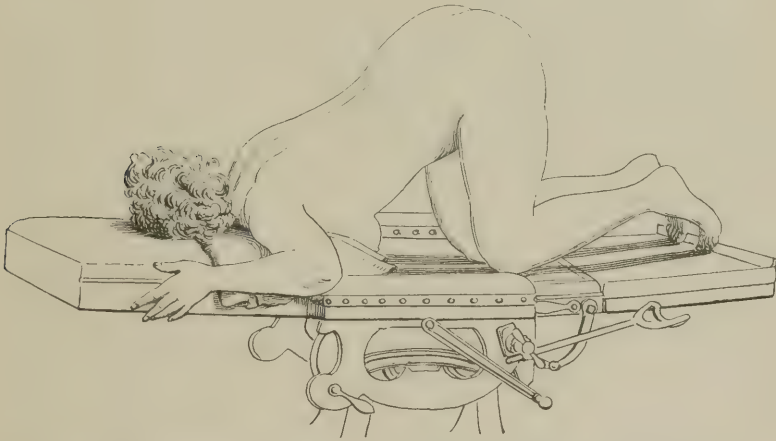


Fig. 28.—Knee-chest position. (Drawn from photograph of model.)

assisting nature in re-establishing a normal nutrition and normal performance of function. Some of these methods may be here described, particularly those coming under the general description of means that may be used alone or in conjunction with electricity in curing these affections without resorting to surgery.

Posture.—We are indebted to Dr. H. F. Campbell, of Georgia, for a systematic method of replacement of prolapsed and retroverted uteri in which the normal gravitation of the vagina is reversed by placing the patient in the knee-chest position (Fig. 28) and admitting

air into the vaginal orifice. In the conditions of relaxation of the vaginal and abdominal walls present in these affections the admission of the air permits the parts to fall forward by their own weight. This is the only proper method of reposition of these parts by the physician prior to inserting the sound, but is especially advocated by Dr. Campbell as a "pneumatic self-replacement" method by which the patient herself inserts a small tube while in the posture when retiring at night and on rising in the morning. Any short tube with rounded edges will do for this purpose, preferably a small glass tube, but the detached vaginal nozzle of a syringe answers every purpose. It is important to remember that the clothing about the waist should be well loosened before resorting to this valuable procedure, and that the thighs should be perpendicular, as shown in the drawing, with the sternum directly in contact with the couch.¹

Hydrothermal Applications to the Pelvis.—*The Hot Vaginal Douche.*—Vaginal injections are of service in a variety of ways, either for cleansing purposes, for vaginitis, and as a method for modifying the circulatory and nutritive conditions of the pelvic organs. It is their use for the latter purpose that requires mention in this place.

Emmett was the first to popularize the use of the hot douche of sufficient bulk to modify pelvic conditions and administered in the recumbent position, and it may be stated that it is only in this position and when followed by repose that it is valuable as an alterative. It is readily administered by the nurse while the patient lies in bed by the use of a bed-pan and a pillow laid just above it, a board being slipped under the sheet if the mattress be soft and yielding. It may also be administered by the patient herself as follows: Procure a square yard of rubber sheeting and lay it on one side of the bed with the projecting side draped to convey the water into a vessel placed beneath it on the floor. She then fills a two-quart fountain-syringe with plain or medicated hot water of a temperature barely permitting the hand to be held in it, and hangs it on the head-board of the bed at a height of about two feet from the mattress. She then lies across the bed with the hips on the rubber sheet and the vulva close to the edge of the bed, each foot being supported on a chair drawn alongside, when the nozzle may be inserted and the catch released.

¹ Dr. Skene limits this procedure as a self-treatment to this position only, wisely condemning any elaborate efforts at self-medication.

The nozzle should be constructed with side-openings only and should be of large size at the tip to prevent injection of the water into the uterus,—an accident that has frequently resulted in painful, and even dangerous, uterine contractions. Improved devices are now sold for vaginal douching, particularly instruments which occlude the vulvar opening and compel a dilatation of the rugæ of the vagina and a more thorough application of the fluid.

The remedy is unquestionably a valuable one in acute and sub-acute pelvic inflammation, and particularly in pelvic peritonitis, but the author sees many cases of more chronic inflammation in which it has failed to be of use. A word of caution should be said concerning the relaxing and what might be called tactile benumbing effects of this procedure when practiced for too long a time. Certain cases of abnormal relaxation and insensitiveness have been observed by me in young women who had gone through a course of treatment of this nature, but this may have been due to the fact that they had been led to continue the practice indefinitely for the temporary relief afforded or by reason of a belief in its necessity as a means of keeping "clean." Now it is quite evident that nature never designed that these sensitive parts should require cleansing in this way, and that even the repeated contact of simple water may have a hardening effect on virgin surfaces, at least, that are normally bathed in mucus. The normal vagina is quite capable of attending to its own cleansing in a physiologic way. If this secretion is abnormal the douche is, of course, imperative, but when the abnormal secretion is of uterine or tubal origin, something more definite in the treatment of the seat of the discharge is needed and no amount of vaginal washing will be effective.

Vaginal Swabbing.—For refractory cases of colpitis the best application is a douche of sublimate solution, 1 to 5000, administered by the physician through a speculum, or the vagina may be swabbed out with pledgets of absorbent cotton dipped in the same solution or in equal parts of tincture of iodine and glycerin.

The iodine and glycerin swabbing is also a favorite method with some in the treatment of chronic pelvic inflammation, whether affecting the uterus and appendages alone or the cellular tissue, but is usually inferior to positive vaginal applications of the galvanic current with a cotton-covered electrode.

Tampons.—The tampon, constructed of a cylindrical wad of absorbent wool, or, in its absence, of absorbent cotton, has of late

become a favorite routine treatment for chronic pelvic inflammation and for conditions of the uterus formerly treated by pessaries. For this purpose the tampon is medicated with various substances, chiefly boroglyceride or some other preparation of glycerin for its drainage effect. In constructing the tampon for this purpose a piece larger than the palm of the hand is spread out in the form of a cup and the boroglyceride poured in; the outer portions are now brought together and tied with a string long enough for both ends to project beyond the vulva. It is now inserted quickly through the speculum already in position by means of dressing forceps, enough cotton being left dry to prevent the liquid from exuding. This is left in from eight to twelve hours, at the end of which time it is withdrawn by the patient by traction on the strings, and the vagina is thoroughly douched.

In the use of the tampon for checking hemorrhage the Sims position and Sims's speculum are decidedly preferable, the vagina being packed full of iodoform gauze by tucking in a little at a time and packing the vault first. In the absence of the gauze, pledgets of absorbent cotton dipped in a saturated solution of alum and pressed dry may be used instead. The tampon should be removed by the physician himself at the end of twenty-four or thirty-six hours, and the vagina should be cleansed and repacked if necessary. This procedure is invaluable in dangerous hemorrhages, but is rarely necessary when we have at hand the primary, or the coarse-wire, faradic current, by means of which the source of the bleeding may be directly controlled by causing immediate contraction of the uterus.

Pessaries.—Of pessaries and other artificial supports of the uterus the author has but little to say that is not condemnatory, since they usually produce a harmful distension of the vagina, with ultimate disappearance of the muscular coats. He has been able to obtain better results by electricity in all cases except those of pronounced paralysis or muscular degeneration of the vaginal walls (generally contributed to or caused by a long course of pessary wearing) with cystocele or rectocele, and in this exceptional class alone has obtained good results from the Smith-Hodge pessary where the perineum was at least partially intact.

Massage.—Massage, or the art of applying intermittent mechanical force to the tissues of the body, is a most important adjuvant to electricity in the treatment of the neuroses of women and the neural consequences of pelvic and abdominal disease. In the disorders under

consideration it becomes of value mainly as a peripheral application and as a means of restoring general nutrition. As such, it is a necessity in the "rest," or Weir Mitchell, treatment, and may be useful at times, though less frequently, in the treatment of ambulant cases. For descriptions of the methods of applying massage and of its physiologic action in the cure of disease the reader is referred to the works of Schreiber, Douglas Graham, Dowse, and others.

The author regards massage with the hand as the only efficient method of using the agency in the class of cases under consideration, rejecting all machinery, muscle-beaters, etc., as either but poor substitutes for the hand of the *masseur* or as presenting an entirely different therapeutic measure.

Most books on massage treat more fully of Swedish movements than of massage proper. While the former have a very great value in many chronic conditions, the latter is particularly indicated in the class of affections under consideration, the Swedish movements being added in the shape of passive movements of the joints only.

CHAPTER VII.

MENSTRUAL DERANGEMENTS.

MENSTRUATION, essentially a neuro-vasculo-glandular phenomenon, is probably more directly affected by electric applications than any other function of the body. Demanding a certain equipoise of the nervous elements constituting the aptly-named "abdominal brain," the inevitable result of currents so applied as to affect these nerve-structures is the regulation of the function when deranged in any way, particularly when the flow is aperiodic or deficient in quantity or quality. The condition present in many cases is essentially of a neurologic nature, requiring methods of a nerve-stimulating character, rather than strictly local or cataphoric applications. Where the derangements are, on the contrary, accompanied or caused by physical changes in the uterus or adjacent organs a method aiming at correcting the local conditions is essential. Owing to the nerve-relationships of this function, it will be found that any extensive electric treatment of any portion of the body, at or near the menstrual molimen, will tend to increase or hasten the flow, and particularly is this true of intra-uterine galvanic treatment, during which it is well to warn the patient of this peculiarity. Where no abnormality of menstruation exists, therefore, it is well to intermit general electric treatment of any character during the period, unless, indeed, it is desired to increase its duration or amplitude.

Amenorrhea.—In the irregularly-appearing, deficient, or suppressed periods of young girls just entering womanhood the abdomino-dorsal application of either the galvanic or faradic current, negative to abdomen, is particularly indicated (preferably the galvanic), the slight exposure of the person freeing it from objections inherent in any other method. It is, of course, incumbent on the physician to inquire closely, so far as possible, into the causes of the irregularity, and to institute additional means for their removal. Sedentary habits, overstudy, deficient assimilation of food, and particularly autointoxication from accumulated secretions within the alimentary canal, will

most often be found to be the causes that lead to irregularity in the development of the sexual organs, and these must receive appropriate attention. In certain cases, however, the suppression occurs in otherwise healthy and even robust individuals as a result of mental or climatic influences or a change of environment, as when a girl removes from the country to the city or goes on shipboard to a new country. I have even noted such irregularity in the case of a girl who went south from Philadelphia to a more rural section. In the former case electricity should be conjoined with the other indicated remedial procedures; in the latter it will be sufficient alone, as the nervous system is mainly at fault. Whether the suppression be due to a general debility or to a mere disarrangement of the nerve-forces, a stimulation of the neuro-vascular processes in the pelvis is most beneficial. The current should be thoroughly applied to the abdominal and pelvic sympathetic plexuses and to the lumbar enlargement. The patient lying upon the large pad, the round pad should be applied alternately to the epigastrium and hypogastrium, from 50 to 100 milliamperes being employed, of the galvanic current, followed by a strong primary faradic. There are very few cases, indeed, that resist strong currents thus applied, though vaginal and intra-uterine applications may exceptionally be required as a still stronger stimulus to the nervous processes of the pelvis. The active pole in the latter applications should invariably be negative, on account of its marked congesting, stimulating, and moisture-attracting powers.

Not a little of the benefit derived from the external applications in these cases is due to the correction of the constipation and imperfect chylopoiesis, which is usually responsible for the condition.

Scanty Menstruation.—If electricity at times is only an adjuvant to tonics and laxatives in the amenorrhea of weakly girls, it may, on the other hand, be regarded as an all-sufficient reliance in the scanty menstruation of mature women. This latter condition is frequently associated with neurasthenia, both in women of slight build and in those who are becoming too fleshy. The normal tidal wave of functionation is deficient in both, resulting in an "edginess" of the nerves that renders the patient miserable for a week or more in each month, or else permits her to take on fat by an accumulation of reserve material that would otherwise be thrown off, as suggested by Laphorn Smith. In these cases we may employ simple bipolar faradic currents from the fine wire to the uterus or vagina as a nerve-stimulus,

as recommended by a number of writers, or the negative galvanic current to the vaginal surface of the uterus or to the cavity as I usually prefer, employing from 10 to 20 milliamperes. A good plan is to alternate the galvanic and faradic applications, the galvanic being applied every two or three days.

Both currents are indicated in the attraction of blood and nerve-force to the pelvis, and some patients will quickly notice a relief in the symptoms of cerebral fullness and discomfort, which they rightly attribute to the scanty flow, even before the appearance of the next period. From what has been said of the effect of any electric application on the period it will be seen that this treatment should be continued until the actual appearance of the period, and may even be applied after its appearance, to intensify the effect.

A striking illustration of the effect of an increased flow on the nervous system was observed in my practice recently in the case of a lady who had suffered from cerebrasthenic symptoms for several years, associated with nervous dyspepsia, scanty menstruation, and sterility. The uterus was retroverted, but otherwise healthy. Complete relief of the gastric symptoms did not relieve the monthly accession of irritability until treatment was applied to the pelvis. One negative intra-uterine application a few days before each period brought on a satisfactory flow with the desired relief.

Menorrhagia.—*Menstrual pain; dysmenorrhea.*—The list of pathologic views that have been advanced in accounting for what is usually called dysmenorrhea is somewhat extended, even when the term is restricted to the uterine type of painful menstruation, excluding ovarian and inflammatory pains and true neuralgia. Those most prevalent at the present time are, on the one hand, the mechanical theory of obstruction from stenosis or flexion, which may be called the Marion-Sims theory, and, on the other hand, the parametritic theory of Schultze. As to the first, it is not sufficiently well known that this latter observer has completely upset the obstructive or mechanical theory by demonstrating that a sound may be passed during the crisis of a supposed example of accumulation without encountering fluid: an observation which I have verified on a number of occasions. In several instances in which I have made intra-uterine applications during great pain the cervix was found, on the contrary, to be distinctly more dilated than at other times. The obstruction theory is also weakened by the examples of stenosis and ante flexion that

occur without painful menstruation. Yet Schultze's theory of para- or peri- metric inflammation as a cause is not by any means satisfactory. That it has failed of practical acceptance by those even who advocated it is shown by their adherence to dilatation as a means of cure.

In that excellent picture of painful menstruation contributed by W. Gill Wylie to the "American System of Gynecology" another pathologic condition is suggested: hyperesthesia of the endometrium. That an hyperesthetic condition of the cavity does exist in these cases I think anyone who has passed a sound into them will admit. The exclamations of pain when the internal os is passed are most characteristic, and, in cases where a proper gentleness has been observed, must be other than normal; yet there are certain facts which indicate that hyperesthesia is but one of the conditions present. In a typical attack of painful menstruation the first thing to appear is the pain, which precedes the flow by an appreciable interval. How a mere hyperesthesia of the endometrium can explain this does not appear clear. In the great majority of such cases the pain ceases, in part or altogether, after the flow has been established, and it is this fact particularly which has intrenched the believers in the purely mechanical or obstructive nature of the trouble, which, in its boldest form, attributes the pain to a damming up of the menstrual fluid by a too narrow outlet, through which it is forced by a "mimic labor." To Schultze's demonstration of the absence of an accumulation, which is corroborated by an absence of dilatations above the alleged stricture, may be added another argument against this latter view, in the fact that analogous conditions of stricture, as in the male urethra, are not attended by premonitory pains, but by greatest pain during the actual flow. The "mimic-labor" illustration is inappropriate for the same reason. Finally, the non-existence of a fibrous mechanical stricture is proven by the fact that ether will relax the apparently stenotic internal os sufficiently to permit a large dilator to be inserted.

A better explanation of the etiology of painful menstruation is that which regards it as almost entirely a neuro-muscular phenomenon. The attempt at the performance of an important function while either the nerve-centres in the cord or the uterus itself are in an unprepared condition results in pain. If the trouble is in the uterus the pains assume a nature that the patients themselves have accurately described as "cramps." In a paper read before the Philadelphia

Obstetric Society, December 5, 1889, the author proposed for this condition the name of a "menorrhspasm." That the spasm alone is the parent of the pain rather than retained excretion is more than likely, an associated sequence being an inhibition of the excretory act until relaxation has occurred.

Menorrhspasm, in brief, may be said to be a neuro-myotic storm of the uterine neuro-muscular apparatus, which renders the excretion of the menstrual fluid temporarily impossible. Its exciting cause may be either lack of development of the organ or morbid conditions of the endometrium, while its remote causes are traceable to all those influences in modern society which hinder the proper development of animal life in young women.

That a spastic muscular contraction, most noticeable at the

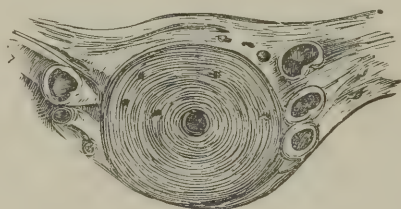


Fig. 29.—Section of uterus made at os internum (*ad nat.*), showing the normal size of the os internum, the circular disposition of the fibres around it, and the blood-vessels in proximity. (Barnes.)

internal os, usually accompanies the menorrhspasm is undoubted, and there is reason to believe that the contraction may be excited by the sound between the periods. The predominance of circular fibres at the internal os, which is clearly shown in the accompanying cut (Fig. 29) from Barnes's "Diseases of Women," offers a ready explanation of this.

If such views of this condition are correct, it becomes evident at once that a better name than "dysmenorrhea" (difficult menstruation) should be used in describing it, particularly since this term at once suggests mechanical conditions only, with the harsh treatment appropriate to such. At the meeting referred to, the author, while advocating the view that the causative condition was a menorrhspasm, urged the general use of the merely symptomatic designation, "menor-

rhalgia" (menstrual-flow pain) in preference to "dysmenorrhea," as, in itself, involving no theory.

Accepting the neuro-muscular view of the cause of these pains, the oneness of the pathologic condition in all cases is at once apparent, the differences being only matters of degree. In the one case, the neuro-myotic storm is but a danger-signal pointing to a neurotic constitution, vasomotor disturbances, spinal irritation, abdominal torpidity, or even merely habitual constipation; the attempt at the performance of a high function in the presence of these disabling conditions resulting in pain. Given a high degree of uterine neuro-muscular incapacity and the spastic spasm occurs in the absence of these allied conditions, rendering direct local treatment imperative for its relief.

We have, then, a simple and convenient division of cases of menorrhagia into those not requiring local treatment and those in which local treatment is necessary. The dictates of common sense unite with the high obligations of the physician in urging him to assign all cases of menorrhagia in virgins to the former class, at least until he has demonstrated by a failure of general methods that a local examination is imperative. The author cannot too strongly condemn the general habit of hasty examination in these cases,—a habit that is a direct sequence of the ultramechanical views of the day.

For practical purposes a still further division of cases requiring local treatment is wise, since some cases are either due to, or accompanied by, catarrhal conditions yet confined to the uterus, while others present manifest congestion, inflammation, or other morbid conditions of the ovaries.

Nervous Menorrhagia.—Menorrhagia of the lesser degree, and even the most painful form, when accompanied by derangements of the nervous system or of the abdominal viscera and unaccompanied by organic uterine disease, is best treated by percutaneous galvanic applications, abdomino-dorsal, or even merely spinal, the dose varying from 10 to 60 milliampères, *pro re nata*. Large, well-moistened electrodes, and the gradual manner, without shocks, should be used.

In addition to many cases of pronounced menorrhagia relieved by external treatment, I have a large number of instances recorded in my notes where young girls undergoing spinal applications of the galvanic current for different objects have volunteered the information that various amounts of menstrual pain had disappeared while

under treatment. These cases generally improve in blood and weight also, but I have seen numerous instances where the lessening of the pain preceded any possible influence on the general health, being found in a period coming on but a few days after the beginning of the applications.

A systematic treatment of this sort should consist of thrice-weekly or daily applications, beginning at the termination of a period and lasting until the next flow has appeared. Two months of such treatment, combined with proper means for the regulation of the bowels, if required, will usually be sufficient to make a permanent cure.

Uterine Menorrhagia.—In spite of most careful treatment, nevertheless, many cases present a menorrhspasm of so pronounced a local character that nothing short of direct treatment will be of service. The frequent association of endometritis is also a determining fact in favor of local treatment. It is in these pronounced cases that dilatation has been of service, the possible explanations of its action including an alterative effect on the endometrium and the trophic condition of the organ, as well as the mere paralyzing effect of the divulsion.

In my experience a more certain and less formidable remedy for these intractable cases of uterine menorrhagia may be found in the intra-uterine action of one pole of the galvanic current,—usually the negative pole when a promotion of flow is also desired, or the positive pole if the endometritis be pronounced,—the strength varying from 15 to 50 milliamperes, *pro re nata*. From two to six applications may, at times, be sufficient, extending over one or two intermenstrual periods. As contrasted with forcible dilatation, this method is simple, free from danger, does not require an anesthetic, and may be employed in young girls without the use of a speculum. The following typical case may be cited as an illustration:—

Miss A. C., aged 24. Puberty at 13. Menstruation regular, normal in amount, always extremely painful. No leucorrhœa nor intermenstrual pain. The menorrhagia presented the usual characteristics, accompanied by hyperesthesia of back and abdomen and pains down the limbs, and had been markedly increasing for the last six months. As she was constipated, a course of laxatives and lumbosabdominal galvanic applications was followed for one month without effect. Examination then revealed a small uterus with fundus forward, os virginal, and appendages healthy. After patient efforts an

electrode was inserted to the internal os only, and 25 milliampères, negative, applied for two minutes.

Six days later the sound went to the fundus with but little trouble, and 40 milliampères were used. The ensuing period was less painful, permitting sleep for the first time in months during a menstrual period. The sound now entered with ease, and two more applications were made, followed by a perfectly painless period. Six months later the patient reported perfect health and continued immunity from pain.

Such a case is clearly an instance of lack of completeness in development, and it is very likely that faradic currents would have been equally successful in the treatment.

But by far the larger number of cases of so-called dysmenorrhea, or menorrhagia, are really instances of endometritis with menorrhagic symptoms, and in these cases the ease of cure under electricity is no less an arraignment of the harsh methods of treatment by forced dilatation than the instances in which stenosis is one of the incidents of lack of development. Case after case has been sent to me after thorough dilatation has been fruitlessly used in which the only evidence of organic abnormality that existed at any time was a catarrh of the endometrium. When these cases can be cured by from one to a dozen applications without mutilating and cicatrizing the uterine mouth it is high time that such illogical procedures should be relegated to the obscurity of an historic fad. Certain electro-therapeutists even are not free from the influence of this disproven theory of obstruction, for they recommend electric dilatation with a series of graduated bulbs as the negative electrode. If there is any need of dilatation this is, of course, the typical method, but I myself never have occasion to employ any kind of dilatation in the treatment of these cases, unless the use of an ordinary sound-shaped electrode may be so called. Any case that can readily admit such an electrode is amply large for any flow, and the passage of clots is best treated by the cure of the causative endometritis. This statement of the required calibre of the cervical canal is not based on actual measurements, but upon the uniformly successful results of a large series of cases treated by electricity administered from an instrument of the same size (that of the Simpson sound) and without other dilatation than this instrument might produce. There has not been a single instance of failure to cure.

A cervix with the characteristic pin-hole os, with or without a contracted internal os, is unquestionably atresic, it is true, but this is only one symptom of a general sexual maldevelopment. A painstaking insertion of an ordinary electrode, assisted, at times, by 10 milliampères, negative, before it slips past the internal os, and the administration of from 15 to 30 milliampères, negative, will, if repeatedly employed, so lessen the hyperesthesia and increase the nutrition that the better-developed uterus will admit the sound easily and almost painlessly, and painless periods will follow.

When the case is clearly one of virginal endometritis, of which the chief symptoms are the menorrhagia and a leucorrheal discharge, the intra-uterine galvanic treatment is indispensable, but the positive pole should be employed, with from 15 to 40 milliampères, twice a week. When the os is sufficiently patulous to admit an elastic electrode far less discomfort will follow its use than the stiff instrument, and it is even better to cover the bare surface of the spiral lightly with absorbent cotton dipped in hot water and soaped if the additional bulk will not be too great for its insertion.¹ At the end of the five minutes devoted to this current and before withdrawing the electrode a faradic current should be turned on from a medium secondary coil, strong enough to be distinctly felt by the patient. The finger should always support the cervix at the moment of removing a cotton-covered electrode from the cavity, as it is apt to be somewhat tightly clasped by the uterus, causing the latter to be dragged downward. When the catarrh is confined to the body alone it is generally impossible to insert so bulky an instrument as a cotton-covered electrode, the folds of the cervical mucous membrane being capable of being eluded only by the painstaking use of the stiff instrument curved to suit the case.

The following typical cases illustrate the details of treatment:—

Miss A. D., aged 24, referred by Dr. Woodbury, gave a typical history of menorrhagia with endometritis dating from puberty. External treatment failing to relieve her, an examination was made and the uterus found exuding considerable mucus, though small and ante-flexed. The internal os was small and admitted the sound with difficulty. Twenty-five milliampères, positive, were given for five minutes on April 29th. Five days later 40 milliampères were given; on May

¹ The appearance of the cotton after removal of the electrode will also be a material aid in diagnosing the condition and progress of the case.

7th the flow came on several days ahead of time with much less pain. During the next intermenstrual period two applications of 40 milliamperes, positive, were administered, and at the next ensuing period the patient was entirely free from pain or discomfort, and no leucorrhea followed it. No treatment was given this month, but the next period, being slightly painful, two more application were made, resulting in a permanent cure.

Miss P., aged 22, was referred to me by Dr. Egbert H. Grandin, of New York, who had ineffectually used dilatation. Pain continued constant and at periods intense, requiring her to remain in bed. Examination showed an enlarged uterus, free leucorrhea, and tenderness of left ovary. She received six applications of 30 milliamperes, positive, to the cavity during two intermenstrual periods, resulting in complete relief. Six months later she was well and gaining in flesh.

Miss R., aged 20, was referred to me by Dr. Bayliss, of Knoxville, Tenn. Since a delayed puberty at 16 she had always been menorrhagic. The pain is worse after the flow begins, and during its height she "wants to die." A pain persists in the thighs between periods. On admission to the sanatorium examination showed the uterus, with the slight enlargement usual in these cases, tender and deviated to the right. A copious leucorrhea existed. She received intra-uterine applications of 20 to 25 milliamperes, positive, February 16th and March 5th, 14th, 20th, and 24th, accompanied by daily general galvanic treatment for the nervous symptoms. The treatment was interrupted at this time by the patient's presence being necessary at home, and, though considerable improvement persisted for a time, there was a return of leucorrhea, with some pain, a year later. The result would, doubtless, have been perfect had stronger galvanic currents been used, assisted by local faradic treatment.

Miss S., aged 20, had for several years had an increasing leucorrhea with a menorrhagia that was becoming worse. The uterus was normal except for a muco-purulent catarrh and hyperesthetic cavity. Five applications of 30 milliamperes were made to the cavity, resulting in a perfect cure, verified by five years' subsequent observation. One of the earlier applications was made during the early hours of a period and the interesting fact observed that the uterus was more patulous than usual at the beginning of the flow in spite of intense cramps, thus adding another proof that the pain in these cases is not due to obstruction.

Miss H., aged 25, admitted from Wilmington, Del. This young lady was much reduced in health by a moderate uterine catarrh with menorrhagia that had kept her in bed one day of each month for ten years and in an exhausted condition one week in each month for some time. The softened, eroded os and enlarged uterus required the touch only to establish a satisfactory diagnosis. The treatment was with both currents intra-uterine, the galvanic current usually being 35 milliampères. The use of cotton on an elastic electrode was practicable, and the progressive improvement was well shown by the gradual improvement in the appearance of the cotton after removal, the earlier applications leaving it saturated with bloody mucus. The cure was complete, and attested by quite a change in her appearance.

It has been my fortune to have had under similar observation and treatment some fourteen other cases of the same character,¹ and it is not too much to say that they were all surely rescued from a slowly impending invalidism for which an unsexing operation would have been advised when the tubes and ovaries had become involved.

Ovarian Menorrhagia.—So much for the neural and uterine forms of menorrhagia. But it should be understood that some cases are distinctly ovarian in origin, and by this is meant that the process described, of a neural predisposition and catarrhal aggravation, has proceeded so far as to finally involve the ovaries in organic changes,—usually of a merely congestive character, but none the less organic. In these cases any intra-uterine treatment should be carefully avoided and reliance placed on the applications described elsewhere for ovarian congestion or ovaritis. Such cases may be detected by noting that the patient has an intermenstrual tenderness, and on examination presents the characteristic boggy in the ovarian regions. Yet it is not always possible to clearly distinguish between the cases that are of uterine origin and those in which the ovaries are involved, for the evident reason that the uterine seat of the trouble frequently persists after the case has developed ovarian symptoms from neglect or rash treatment, and in this predicament we must rely mainly on the vaginal applications recommended in ovaritis and salpingitis, interspersed with such gentle intra-uterine applications as the progress of

¹ American Gynecological and Obstetrical Journal, page 201, February, 1896.

the case will warrant. The following case is a good illustration of this difficulty:—

Miss —, aged 18, had been dilated one year previously by a prominent surgeon, under ether, she having entered a hospital for that purpose. This not only failed to relieve her, but apparently transformed a simple uterine menorrhagia into an ovarian menorrhagia, since there had been a constant intermenstrual pain since the operation which she did not have before, and under which her general health was breaking down. She was placed on vagino-abdominal applications of both currents until the intermenstrual pain should be controlled, which did not occur for at least three months. During this time there was little or no abatement of the menorrhspasms themselves in spite of a general restoration of health. Intra-uterine positive applications of 25 milliampères were now made three times a month, with complete cure after three additional months. This lady has since married a professional colleague and remains in excellent health.

Menorrhagia and Metrorrhagia.—An inordinate flow at the periods, if persistent, is usually due either to an endometritis, to retained shreds of tissue from a miscarriage, or to neoplasms. When due to either of the latter causes, the flow partakes of the character of a metrorrhagia, and may appear between the periods or even be constant.

There are, nevertheless, a sufficient number of instances of simple menorrhagia unaccompanied by leucorrhea in young girls, evidencing laxity of tissue and vasomotor disturbance. Internal medication and hygienic regulation is usually indicated in these, and is ordinarily successful. There is also a type of persistent menorrhagia without leucorrhea in married women, of what might be said to be an uncertain origin, in which the intra-uterine application of the positive pole is urgently indicated. The following case is an excellent example of this:—

The wife of a clergyman, aged 29, was referred to me by Dr. G. H. Whitcomb, of Greenwich, N. Y., with the statement that she had been greatly relieved of pelvic tenderness and uterine fixation by the use of electricity in his own hands. She had been menorrhagic for some years before marriage, which had occurred five years before seeing me, and had never been pregnant. Of late the pain had become ex-

cessive and the flow very profuse, requiring her to keep her bed during the period. There was no leucorrhea.

Examination revealed a slightly enlarged uterus in good position and moderately movable. The cavity, within which a sound was inserted with difficulty, was capacious and three inches deep. She was placed upon intra-uterine applications of 20 to 30 milliampères, positive, followed by the secondary current, alternating with vaginal applications of 50 to 60 milliampères. She did well on these when not too frequently applied, and after a half-dozen treatments was much improved. The intra-uterine applications were now continued exclusively, once a month, as the lady was now residing near the city, ten such treatments being given during the continuance of a progressive improvement. The treatment was finally interrupted, much to our common surprise, by the evidences of pregnancy, which has since gone on to a happy termination.

This case was under treatment prior to my discovery of the value of zinc-amalgam cataphoresis in hemorrhagic conditions of the uterus. A cure could undoubtedly have been obtained by this method in one-half of the time, or possibly less.

The electric treatment of persistent metrorrhagia from causes local to the uterus, of whatever nature, is one of the most valuable procedures introduced by Apostoli, and it is extremely rare to find a case that will resist the thorough application of the positive pole as directed by him. An essential feature of his method as applied to an intractable case is the direction given that every portion of the endometrial surface should be placed in contact with the electrode in order that the peculiar hemostatic action of this pole should be made to reach all portions of the bleeding surface. The immediate effect of the positive pole thus applied is distinctly hemostatic, as may be demonstrated under the eye in any superficial bleeding surface, but it is also necessary that the secondary alterative effect of the mildly escharotic action should also be secured in all portions of the mucosa of the uterine body. In order that this may be properly accomplished Apostoli advises that bulbous electrodes of carbon be used, the active surface being two centimetres long and of various sizes, in order that the physician may select the largest size that can be inserted. The one selected is carried to the fundus attached to the positive pole of the battery and a current of 50 to 80 milliampères turned on for some minutes; the current is then turned off and the instru-

ment withdrawn to the length of the active surface, which may be easily ascertained by the finger at the os if the shank is marked at appropriate distances, and the current again turned on and the instrument kept immovable for another period of three or four minutes. This procedure is repeated until the bulb impinges on the internal os. The cervical cavity itself should not receive an application in ordinary cases.

The author has greatly improved on this method by substituting amalgamated-zinc bulbs for those made of carbon (Fig. 26), permitting less current to be equally effective, and the application becomes, moreover, thoroughly antiseptic. No other change in the details is made. The particular value of this addition to the Apostoli method is well shown in the following typical case:—

Mrs. —, aged 54, was referred to me by Dr. H. W. Elmer, of Bridgeton, N. J., April 17, 1894. For three or four years before admission to the sanatorium she had been suffering from an almost continuous hemorrhage, resulting in great prostration. Shortly after the beginning of the hemorrhages a tumor of the uterus was discovered, which was the size of a large fist when I first saw her. She was placed under the Apostoli treatment, which produced considerable improvement in the hemorrhages, but did not, even after several weeks' active and six months' occasional treatment, entirely correct the hemorrhagic tendency. Fearing that the case was a malignant one in spite of the absence of marked pain, I decided to substitute an amalgamated-zinc electrode for the carbon one previously employed. It was found that the applications with this electrode were better borne, enabling them to be used more frequently. Six applications were made in a period of two weeks in December, 1894, completely checking the dribbling, and since then there has been no real hemorrhage and the patient has been restored to health. The tumor was materially reduced in size.

CHAPTER VIII.

CATARRHAL AFFECTIONS OF THE UTERO-TUBAL MUCOUS TRACT AND THEIR CONSEQUENCES.

The Etiologic Unity of Uterine and Tubal Catarrh.—It is of the utmost importance in estimating the value of a conservative treatment of these very common affections to recognize the fact that the great majority of inflammatory conditions of the pelvis are primarily due to catarrh of the utero-tubal tract, the initial lesion being a catarrh of the uterus, and that the initial seat of the disease is apt to remain in a more or less active condition during the prevalence of the secondary affections in the tubes and ovaries. It is a belated recognition of this fact that has given rise to the prevalent practice among surgical gynecologists of amputating the uterus itself after subjecting the patient to successive operations for removal of one and of both ovaries and tubes without relieving the suffering. Were such cases placed on rational treatment for the initial lesion none of the operations would have been required, and a great multitude of women would be saved to their families and to a normal existence.

The strong words used on this subject of the wholesale removal of still curable ovaries and tubes in preceding works by the author received criticism in certain quarters, but have never been controverted. It must still be said with regret that this reprehensible practice of destroying important organs without proper efforts to cure them is by no means on the wane.

The pessimistic attitude toward the curability of chronic uterine catarrh itself has even taken the shape of a denial by some authorities of the abnormality of this condition, a varying amount of mucous discharge being said to be natural with most women. This is physiologically incorrect, no really appreciable discharge being ever found in a healthy person except in association with erection. The degree of departure from absolute health is quite accurately indicated by the amount and character of a persistent discharge, which, though constitutional only in certain cases of anemic girls, in every other instance

points to actual local disease if large in quantity or purulent, and is indicative of possible extension in the future to the tubes and ovaries. Chronic endometritis, in other words, not only leads to uterine hyperplasia, but to salpingitis and ovaritis by direct transference through continuity of structure. The most common diseases of the appendages are, therefore, catarrhal in origin and secondary to catarrhal inflammation of the uterine mucous tract, not even exclusive of tuberculosis and of ectopic gestation, both of which are probably invited and fixed by an inflammatory nidus.

For practical purposes, particularly for an intelligent application of electricity to the exact seat of the disease, it is necessary to continue the division of endometritis and metritis into several varieties, each presenting peculiarities of microscopic and macroscopic appearances and clinical history due to the histologic structure of the particular organ mainly attacked or to the state of life of the patient; but it should be stated at once and distinctly that the views now held by most progressive thinkers, and concurred in by the author, class all varieties alike as microbic in real character, and hence pathologically identical, except as varied by the particular microbe concerned, the local structure attacked, and the stage the disease has attained.

Beginning as a glandular proliferation due to the combination of a neural cause with the implanted microbic invasion, whether the latter be a common infection or a gonorrheal infection in a nulliparous uterus or similar invasions in the post-puerperal condition, the tendency is toward an extension of the process to the underlying parenchyma of the uterus, resulting in an abundant formation of embryonal cells in this situation at the expense of the muscular and connective tissues. The process does not advance along the ordinary inflammatory stages of abscess-formation, as in acute inflammatory affections, but, doubtless, owing to a more nearly balanced condition of warfare between the pathogenic microbes and the tissue-defenses, remains in the stage of parenchymal degeneration and proliferation for years unless adequate means be employed for its correction.

The natural history of the affection as manifested in the uterus is therefore divisible into three stages, more or less distinctly separable by their clinical evidences, the first stage being a simple endometritis with leucorrhea, but without interstitial hypertrophy; the second stage showing both leucorrhea and interstitial hyperplasia, the latter often presenting the physical characters of the "engorgement" of the older

writers; while the final stage is one of hyperplasia alone without notable morbid discharges, ending in sclerosis and final atrophy of the muscular structure.

The Therapeutic Problem.—With full acquiescence in the belief that all forms of chronic metritis are essentially bacterial in origin it does not follow that a microbicidal course of treatment is the only indication to be followed, notwithstanding its evident importance even in the latter stages. In these stages of the process a more important indication lies in the necessity for arousing and maintaining more vigorous trophic processes in the parts so long overwhelmed by foreign forces, for it should be understood that in place of the active inflammation we now have rather the *débris* of the bacterio-phagocytic contest to deal with, in the shape of interstitial exudations and proliferated connective tissue. The therapeutic problem involves a correction of these conditions and consequences, which, in the cases usually seen by the specialist, have become a far more important factor in the disease than the original microbic invasion.

The intra-uterine therapeutics of the day, such as the application of caustics and the curette to the interior of the uterus, have, doubtless, accomplished results mainly by arousing the full trophic activities of the part, but, as stated by Apostoli in 1887,¹ "the general reproach which may be made against all intra-uterine therapeutics adopted so far might be summarily formulated as follows:—

"1. It is brutal, blind, and may be dangerous in inexperienced hands.

"2. Its dosage is wanting.

"3. It is difficult to localize.

"4. It has a more or less instantaneous action, which ceases generally after its application.

"5. It is sometimes sterile, inefficacious, or fanciful.

"6. It treats the mucous membrane, but is wanting in direct action upon the parenchyma."

Induced by the success of his work with fibroid tumors of the uterus, Apostoli began, in 1883, to apply a similar technique to the

¹ "On a New Treatment of Chronic Metritis," by Georges Apostoli. Translated by A. Laphorn Smith, Detroit, 1888.

affections under consideration, and subsequently affirmed its advantages in the treatise mentioned to be¹:—

“1. An easy method which any gynecologist can execute alone and without help.

“2. A method which is mathematically dosable; which cauterizes much or little, according to the wish of the operator; and which is marvelously subject to a simple and precise graduation.

“3. Progressive cauterization, which is never instantaneous and which may be administered in fractional doses, the effects of which accumulate at the will of the physician.

“4. An active cauterization which may, if we desire it, go beyond the limits of the mucous membrane and of which we can easily graduate the extent and depth.

“5. It unites the galvano-chemic action contemporary with the passage of the current, and similar, according to the active pole, to that of acids or of bases, and a trophic after-action followed by a process of retrogression and certain disintegration.

“6. A rapid method which offers every facility, according to the intensity of cauterization, to act with variable quickness according to the case.

“7. Absolute harmlessness of the medication, which is made in an aseptic manner and without harshness.

“8. Possibility of localization in a case where we do not wish to effect more than a limited extent of the uterine mucous membrane.

“9. A weapon with a double edge, which, according to the pole in action, is able to give either an hemostatic effect or produce congestion by attraction of moisture.

“10. A cauterization which is antiseptic itself on account of the energy of the released ions of electrolysis.

“11. The application is little, or not at all, painful, and does not require anesthesia.”

The general directions given by Apostoli were in harmony with the known actions of the two poles of a galvanic current,—namely, that the positive pole was to be used in hemorrhagic conditions and

¹ *Ibid.*, page 52.

where a microbicidal effect was particularly desired, while the negative was reserved for hyperplasia alone.

A personal experience that has been by no means small has convinced me that these claims of Apostoli have been fully justified, both from the point of view which requires that the galvano-chemic process be used as a controllable means for the destruction of the morbid mucous membrane, and from that in which reliance is placed on the arousing of trophic activities by less currents applied on covered electrodes. By the process which I have introduced to the profession, in which mercuric salts may be cataphorically applied to the uterine surface and parenchyma, I have, moreover, made it possible to obtain even quicker results in resolution of the morbid process and absorption of the redundant cell-tissue without true cauterization, for in this process the cauterizing oxygen and chlorine are absorbed by the mercury. This method necessitates the use of the positive pole, but is specially adapted to conditions requiring this polarity, and its employment will not only prove to be superior to all surface medication of the endometrium, but render curettage unnecessary except when bulky *débris* exists within the uterus.

Diagnostic Value of Inspection of Persistent Uterine Discharges.

—To the physician not engaged in the major surgery of gynecology only, the nature and characteristics of persistent uterine discharges are a matter of much importance. A large proportion of his cases are sure to be some form of utero-tubal catarrh which is invariably attended in some stage, and particularly in its more curable stage, by an abnormal discharge of some kind. That this discharge is only second to pain as a source of discomfort to the patient, and is a direct issue from the seat of the disease, are facts commanding attention; and our interest is increased when we recall additionally that a mere naked-eye study of the discharge will be of great value in enabling us to decide upon the propriety and exact character of the local treatment.

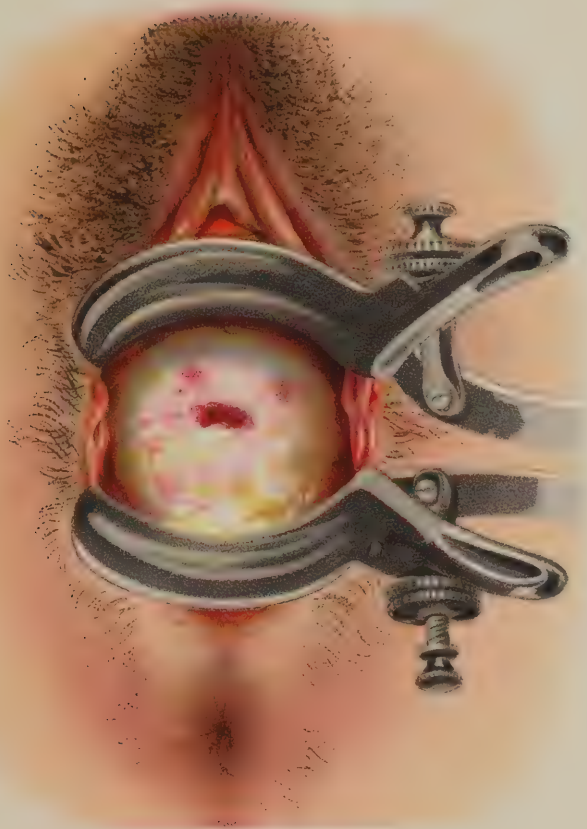
This subject of the character and source of persistent discharges formerly received much attention and was closely allied to the local treatment of those days, but it has had a set-back for two reasons, one being that the earlier gynecologists had not learned to add to these lessons taught by visual examination of the secretions the invaluable assistance of a trained bimanual touch, which checks off and extends the information thus gained; the result was that the mind

PLATE X.



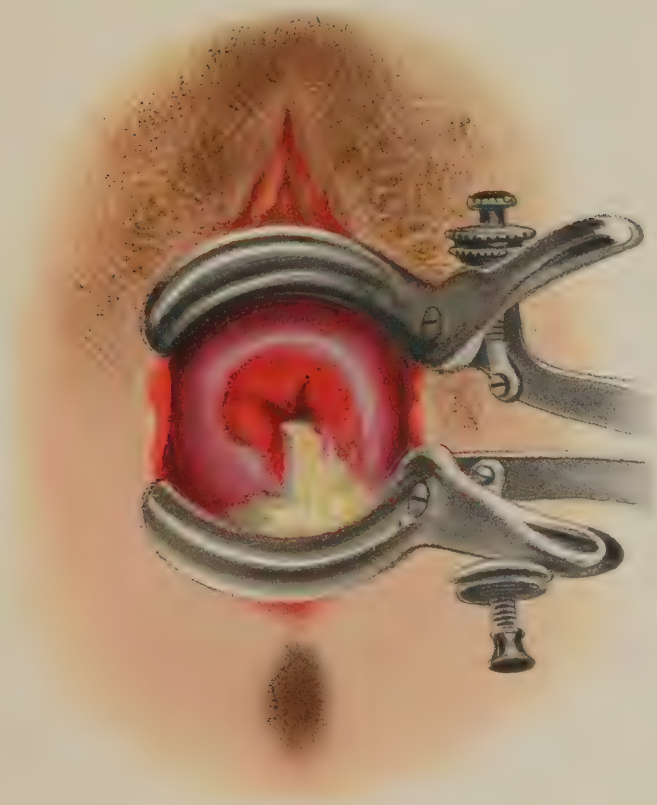
Chronic Leucorrhea of Vaginal Origin.

PLATE XI.



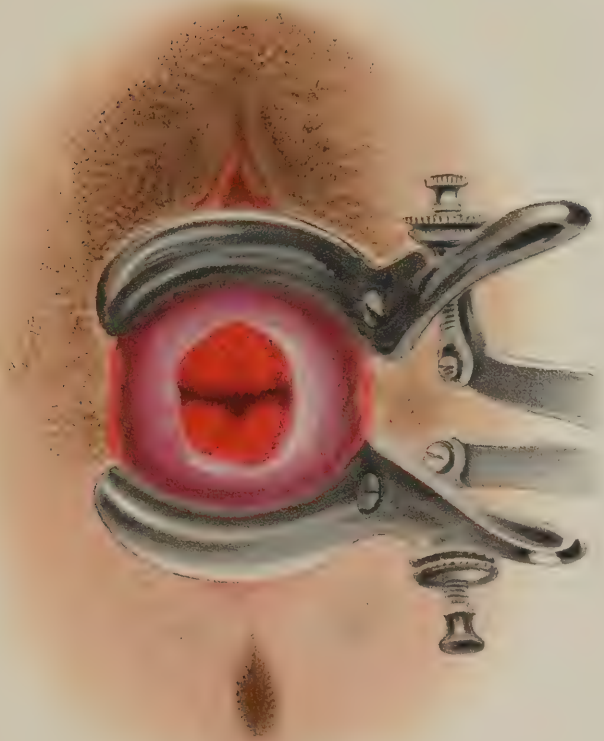
Chronic Purulent Leucorhea of Uterine Origin.

PLATE XII.



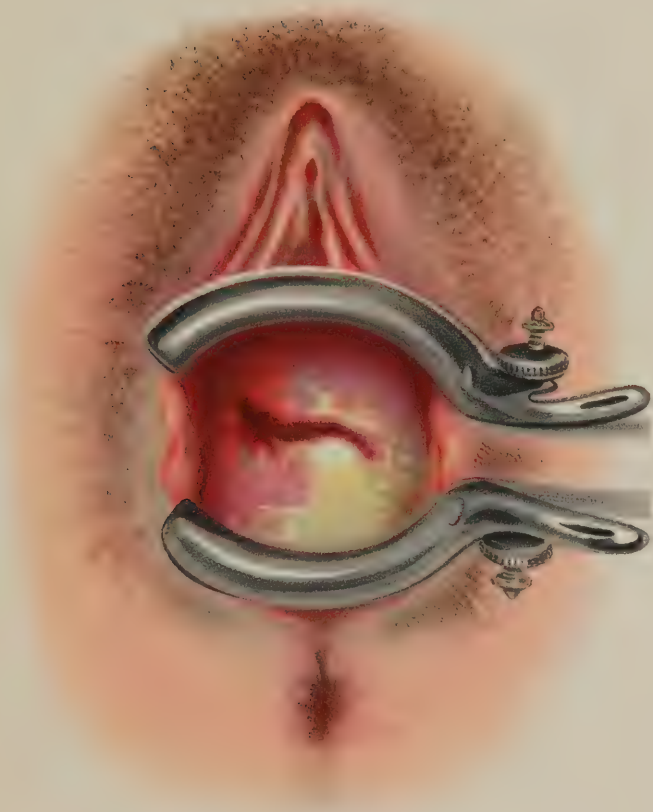
Erosion of Cervix with slight Laceration.

PLATE XIII.



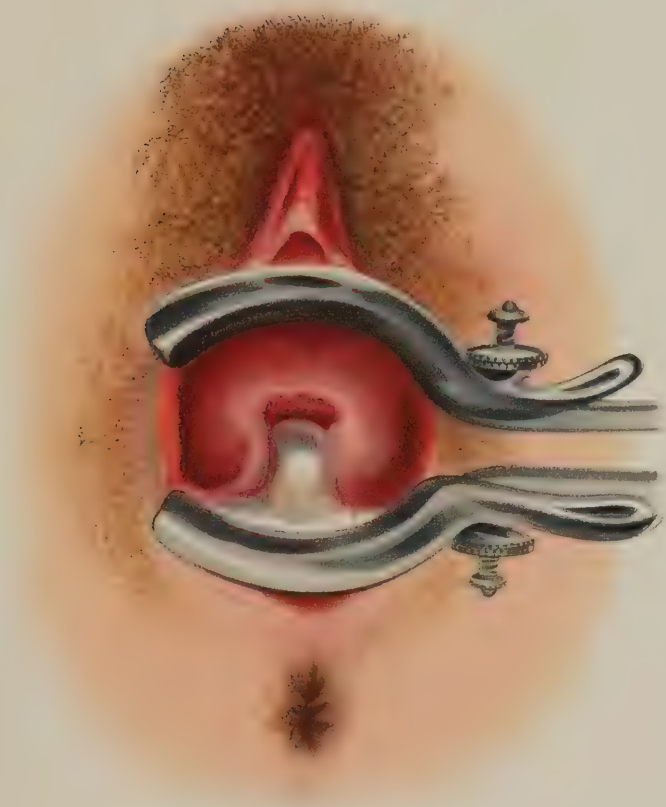
Erosion of Cervix.

PLATE XIV.



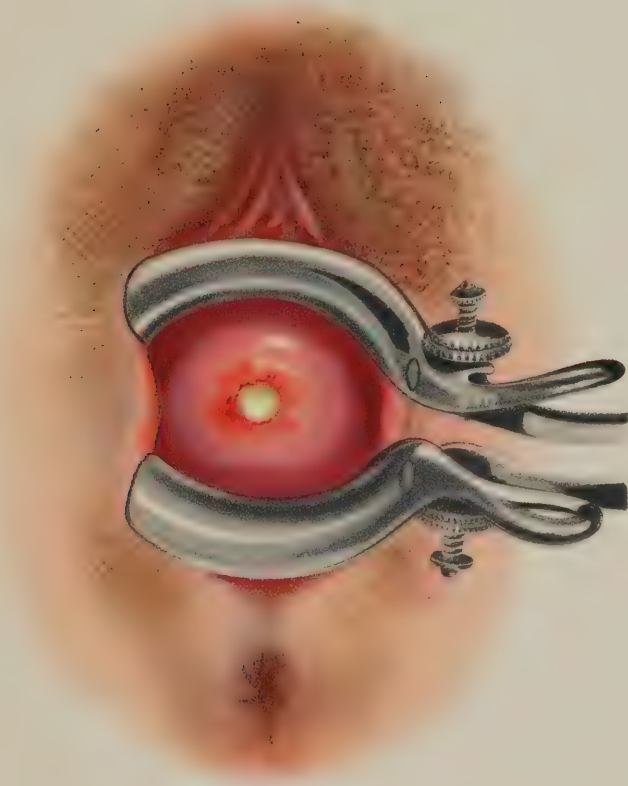
Cervical Endometritis (Early Stage)

PLATE XV.



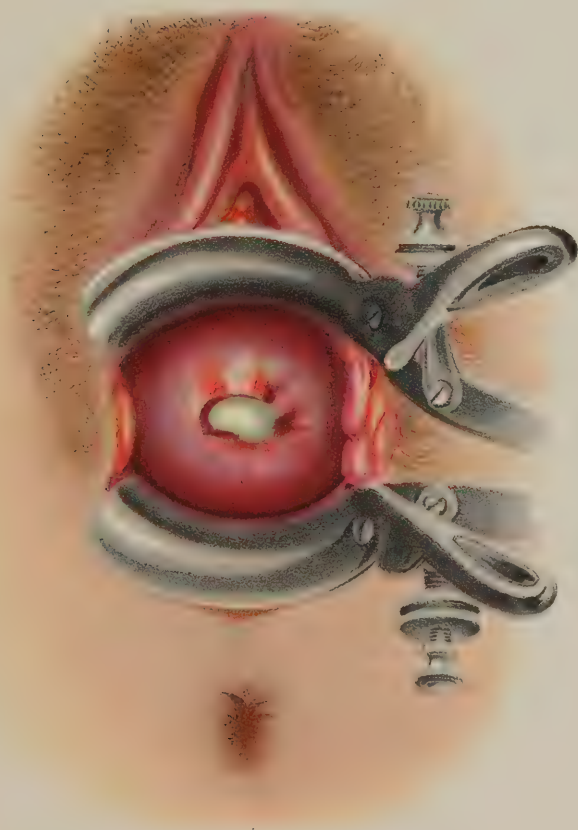
Cervical Endometritis (Late Stage.)

PLATE XVI.



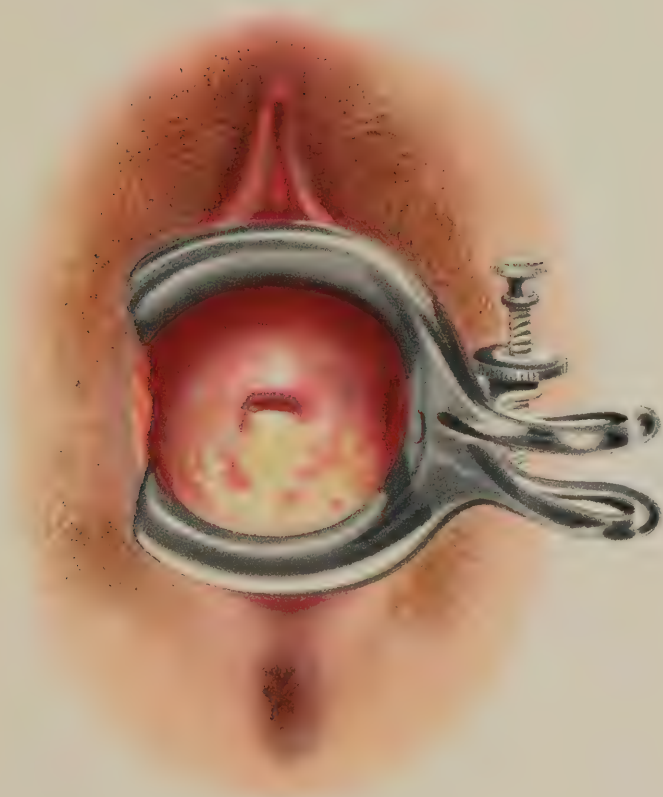
Gonorrheal Endometritis (Early Stage.)

PLATE XVII.



Corporeal Endometritis of septic origin.

PLATE XVIII.



Purulent Leucorrhœa in Metro-Salpingitis of gonorrhœal origin

remained closed to important facts of upward extension of the conditions thus revealed by discharges, and applications were made to the uterus in the presence of salpingitis and ovaritis, which contra-indicated them.

The other reason for the recent neglect of the naked-eye appearances of uterine discharges as a means of diagnosis and an indication for treatment is the therapeutic nihilism of recent leaders in gynecology, who have apparently despaired of curing any form of metritis, and busy themselves with methods for amputation of the organ. This is emphasized by the dearth of exact information in standard treatises as to the character of leucorrheal discharges, though it may be said that the work of Skene is a distinct exception in this respect.

As stated before, all catarrhal conditions of the utero-tubal tract are essentially only portions of the same disease, yet the evidences of a predominant seat of the chronic form of the affection in one or the other location are most important from a practical point of view, for their proper understanding enables us to apply curative agencies with great precision.

In Plates X to XVIII the author presents the first illustrations that have been published of the several varieties of cervical and corporeal discharges of persistent character, drawn and colored directly from nature. For this unique and novel series we are indebted to a rare combination of skill and patience in the artist, who spared no trouble and time in an effort to accurately portray on the spot the typical cases shown him.¹

Cervical Endometritis.—In a state of health there are no appreciable discharges from either the uterus or vagina, save, of course, the menstrual flow and a slight mucous discharge which may precede or follow it, yet, while there is no *excretion*, there is, in a normal condition, sufficient *secretion* from the mucous membranes of these parts for the maintenance of moist conditions, and, doubtless, for bactericidal purposes, on the one hand, and the fostering of spermatie life, on

¹ The coloring of these drawings is vouched for as a correct picture of the typical cases selected, and, as some of the cases were drawn from patients at various hospitals, the artist was enabled to obtain a technical corroboration of the coloring from the physician in attendance in every instance. For clearness of illustration it was, nevertheless, necessary to represent the vagina as shorter than natural.

the other. The normal secretion within the vagina is whitish, acid in reaction, and tends to collect within the folds and about the cervix in unmarried women as a white, curdy deposit (Plate X). The normal secretion within the cervical canal is clear, slightly tenacious, and alkaline in reaction. In a condition of chronic inflammation this secretion of the Nabothian glands of the cervix becomes more tenacious, viscid, and opaque (Plates XIV and XV). It is, at times, so tenacious that it is impossible to wipe it away with a cotton swab. When the stage of the affection is still purulent this viscid, stringy mucus is stained by admixture with pus-corpuscles, and its reaction is at these times acid.

This form of cervical catarrh is unquestionably more rare than the form to be described directly, and is thought, by the author, to be due to a profound microbic invasion of the Nabothian glands of the cervix from gonorrheal infection of long standing.

In the other form of cervical endometritis the most prominent symptom is the "granular erosion," which is found spreading from the external os over a varying part of the vaginal portion of the cervix in an area concentric with the opening (Plates XII and XIII). This was described by Bennett and the older gynecologists as "ulceration of the cervix." The true nature of this morbid condition has been ascertained by Ruge and Veit, in Germany, and de Sinety, in France, to be a morbid proliferation of the epithelium surrounding the external os, in association with a similar condition within the cervical canal. It is, therefore, usually not an ulceration at all, in the sense that a loss of substance exists, though this may be the case, but involves the singular fact that the cylindric epithelium of the cavity of the cervix is said to be reproduced outside of the os within the eroded area where pavement epithelium normally exists. Several explanations of this odd circumstance are given by recent writers, those of the surgical school holding that the condition is frequently produced by an eversion of the lining of the canal by reason of laceration of the underlying tissues of the cervix in parous women, or by a simple ectropion of the membrane by reason of its morbid redundancy in nulliparas. As the condition is most frequently met with in women who have never been pregnant, the slight bearing of laceration on its production is, nevertheless, evident.

It appears to the author that these studies do but little to clear up the practical questions at issue, and that Tyler Smith's claim that

the conditions observed are but secondary to a catarrhal endometritis within the cavity are substantially correct. That an eroded, or, possibly, hypertrophied and altered epithelium without a catarrhal cavity may be produced by an acrid discharge from within it is well proved by the condition noted on the skin beneath the nostrils in neglected children with nasal catarrh, when a practically similar lesion may be seen. In some of these cases the erosion extends to the vaginal walls even, making the resemblance more perfect. If the two conditions are analogous the absurdity of treating erosions external to the os by direct applications to this surface alone is evident.

It is probable that this peculiar form of catarrhal invasion of the cervical cavity is due to a special form of pathogenic microbe, for observers have noted that the affection may involve the cavity of the corpus as well as the cervix. That certain individuals are prone to contract it seems also established.

When the Nabothian glands are also affected there is a tendency to a closure of their ducts, producing shot-like cysts projecting from the surface, which may lead, by pressure atrophy, to extensive cystic degeneration of the cervix.

The constitutional symptoms of cervical endometritis are less marked than when the affection is generally disseminated through the whole organ, yet backache, a sense of weight in the pelvis, and often menorrhagia accompany the leucorrhea.

In the treatment of these very obstinate affections mere applications to the surface will be ineffective for the reason already given, that the disease is situated deeply in the cervical mucous membrane. The most effective electric method is the use of mercuric cataphoresis, for here we have a penetrating microbicide and alterative that may be sent to any depth by interstitial diffusion. The zinc-mercuric method is probably as effective as the gold-mercuric, both being applied in moderate milliamperage of 30 to 50 to the cervical cavity. When associated with moderate degrees of corporeal endometritis, as it often is, it is generally more expedient to employ the mercury on either a silver or copper electrode, owing to their smaller size and the possibility of properly shaping them to fit the cavity.

Illustrative Cases.—A young lady of 22 who had been suffering from menorrhagia with profuse leucorrhea for three years, was sent to me from a neighboring city. As there had been considerable instrumental treatment, resulting in moderate dilatation of the introitus,

a small bivalve speculum was inserted (contrary to my custom in virgins, as erosion is easily detected by touch alone), revealing erosion of the os and a softened and dilated cervix as far as the internal os. On inserting the sound the internal os was found to be normally tight and the cavity of normal depth. It was clear, therefore, that the affection was confined to the cervix alone.

As this case and the following one were seen before the development of mercuric cataphoresis, the treatment employed was positive galvano-chemic cauterization from a bare platinum electrode inserted beyond the internal os and slightly withdrawn before turning the current on. The strength employed was 25 milliampères twice a week, followed by the faradic current. At the end of six weeks' treatment, followed by two weeks' rest, her condition was materially improved as to leucorrhœa and the general symptoms, but the erosion remained little changed. The applications were now made once a week for two months, with a final relief from all symptoms and a better appearance in the eroded area. Just what the condition of the os is at present, four years since the termination of the treatment, is unknown, but the patient remains in excellent health.

Mrs. S., a married lady of 25, who had never conceived, presented symptoms similar to the last patient since her marriage, a period of three years. After much ineffectual treatment she applied to me in March, 1891. Her condition at this time was as follows:—

Her principal symptom was menorrhagia, associated with scant menstruation and intermenstrual backache. Examination revealed erosion extending a half-inch in all directions from the os, with copious muco-purulent catarrh of a tenacious character. The inner os was small and the cavity, as a whole, measured but two and one-half inches.

In spite of the scanty menstruation it was thought best to employ the platinum electrode with the positive galvanic current, beginning with 20 milliampères. The applications were made twice a week. The following period was free from pain and there was a great lessening of the discharge without any improvement in the appearance of the eroded area. After two months' desultory applications treatment was suspended for the summer, as she seemed practically well. In the fall the applications were renewed, owing to one period having been painful and for the purpose of curing the erosion, resulting finally in a complete restoration to health.

Miss R., a maiden lady of 40, had been in poor health for a long

time, but complained principally of a copious purulent leucorrhea and pain in the upper spinal region. There was no menorrhagia. Examination revealed an enlarged, softened cervix, with an eroded surface, which I was able to show to the artist (Plate XIII). Like the other cases mentioned, there were distinct evidences of non-involvement of the corpus.

The treatment in this case was by cupro-mercuric cataphoresis, an ordinary nickel-plated sound being denuded of its plating by dipping it in acid, after which it was amalgamated by redipping in acid and then in mercury and rubbing it on moistened cotton. The strength of the current was 35 to 40 milliampères for ten minutes, repeated twice a week. At the end of two months there was a complete resolution of the eroded area as well as arrest of leucorrhea. She received appropriate medication for her general health at the same time.

Corporeal Endometritis.—Chronic inflammation of the cavity of the body of the uterus is characterized by an enlargement of this portion of the organ without participation of the cervix. This is readily detected by a comparison of the conditions found by simple touch with the enlargement detected by the bimanual touch, and particularly when we find the sound will go to a depth greater than the normal two and a half inches without the cervix's participating in the enlargement. This condition is by no means rare, for it is liable to be found in all cases of chronic metritis due to subinvolution or to retention of septic material,—in other words, whenever the condition has arisen independently of an upward extension from a previously inflamed cervix. The leucorrheal discharge in these cases is serous, whether it be purulent or sanguineous, and is therefore readily distinguished from the cervical discharge, though not so readily observed in the act of issuing from the uterus. The therapeutic management of chronic corporeal endometritis differs so little from that of the larger number of cases of general chronic metritis that further consideration of the subject is incorporated in the following paragraphs.

Chronic Metritis.—The clinical experience of the author has led him to the conclusion that either uterine catarrh or its consequences are responsible for the sufferings of a large proportion of the patients, married women in particular, who consult physicians for symptoms of obvious pelvic origin. Reference is made, of course, to cases of a chronic nature which, on examination, exhibit an enlargement of the

unimpregnated uterus above the size natural to the state of life of the patient. Though such a condition may date from a puerperal sub-involution and the leucorrheal stage be long past, its dependence on an original bacterial invasion is none the less definite, for in an organ of this particular structure the active stage of inflammation represented by the bacterio-phagocytic contest occupies but a small part chronologically of the so-called inflammatory process, the tissue reaction evidenced in a proliferation of the connective-tissue cells becoming a far more persistent feature. The stubbornness of an analogous inflammation of the nasal mucous membrane is quite familiar. The persistence of a catarrh of the uterine mucous membrane is even more likely, for the membrane in this case overlays a tissue more open to invasion, and subject to the periodic congestions of menstruation and pregnancy.

Clear views of this nature are exceedingly important from a therapeutic point of view, and will displace from serious consideration many minor mechanical faults of the uterus to which too much attention has been paid of late. Versions, flexions, and even moderate lacerations of the cervix become of secondary importance in a still movable uterus which is the seat of this trophic-disorder. The versions and flexions are, in fact, often due to the interstitial changes within the uterine wall, either from overweight or unequal distribution of the morbid process to one aspect or the other of the muscular fibres, while the healed laceration which, when it occurred, had opened the avenue of infection, will present no symptoms after the dissipation of the inflammatory process. To cut out such healed scar-tissue at this stage is like locking the stable-door after the horses are stolen.

Such a purely mechanical theory of uterine affections arose in the prebacterial age of medicine, and should be dispassionately reviewed in the light of this important addition to human knowledge.

The direct cause of all cases of chronic metritis is, of course, a microbic invasion made possible by a lessened physiologic resistance or a traumatism. The special microbe involved may be either the gonococcus, in which case *an acute stage must precede the one under consideration*, or more ordinary pathogenic varieties which are always present in the vagina and cervix, but never normally above the internal os. It would seem that the inner end of the cervical canal was, under ordinary circumstances, an inner line of defence against such invasions by virtue of its secretions, and that no pathogenic organisms

succeed in passing this point unless the defenses of the body are lowered by neural conditions or by traumatism.

A cumulative increase in a cervical endometritis, coupled with increased susceptibility, accounts for the upward invasion without traumatism.

Traumatism, as a cause of corporeal endometritis, which is but the earlier stage of parenchymatous metritis, includes the cases due to subinvolution, to the retention of septic remnants of fetal membranes after instrumental delivery or abortion, to laceration of the cervix, and to the harsh use of instruments.

The term chronic metritis includes, therefore, a variety of conditions with widely differing clinical characters, depending on the nature of the tissues mainly attacked, as well as the stage of the affection and the character of the microbic cause.

From certain clinical points of view these cases of chronic metritis are divisible into two other classes that much resemble the divisions made by the late George M. Beard in cases of sexual disease in the male. In the one class the affection occurs as a purely local disease, the nervous organization of the individual being so robust that it fails to be affected by the local disturbance; in the other class a far less degree of local trouble may be found, associated with profound depression and disorder of the nervous system,—a disorder that, at times, seems greatly disproportioned to the local disease. On these reflex symptoms some doubt has been thrown of late, but the best proof that pains in the anterior crural region and in the back, with or without nervous prostration, are caused by this “irritable” uterus is given by the disappearance of such symptoms in a sufficiently large number of cases as a result of local treatment. The reason of the doubt may possibly have been a lack of neurologic training in certain gynecologists, who have mistakenly treated such diseases as hysteria, neuralgia, locomotor ataxia, and even scoliosis, in the writer’s experience, as mere nervous manifestations of pelvic disease. The prevalence and ultimate discredit of the recent fad in which it was attempted to cure not only uterine inflammation, but many nervous diseases, by removing scar-tissue from the cervix, may also be partly responsible for this attitude.

In the first class of cases mentioned the treatment may be carried out in the office, but cases accompanied by nervous prostration are

sued only to the salutary care of an institution in which both the local and nervous elements in the case will receive due recognition.

Intra-uterine treatment is essential in these cases and is only subject to the ordinary rules of gentleness and frequency, since it is assumed that no instances of extension of the disease to the appendages are now under consideration. The galvanic anode has generally seemed best in my practice whenever catarrhal symptoms are paramount, and it is usually followed by either a primary or secondary monopolar faradic current before the instrument is withdrawn. The character of the intra-uterine electrode is also important, the covered elastic instrument being usually preferable and easily inserted on account of the patulous condition of the os, unless, indeed, it be thought best to employ mercurialized electrodes on account of a pronounced abnormality of the mucosa still present. Between the intervals of the intra-uterine treatment daily vaginal applications should be made.

The effect of these relatively strong intra-uterine applications upon fertility deserves consideration. In a series of thirty-two cases reported in a paper before the American Electro-Therapeutic Association, in 1894,¹ I was able to ascertain that six cases had become pregnant since the termination of the treatment. At the same meeting Apostoli contributed a paper also, in which he reported eighty cases that had become pregnant after electric treatment. The proportions reported by me are, of course, not matters of definite ascertainment since a considerable number of the cases treated were not married, and many instances of pregnancy have, doubtless, occurred among the cases treated without the knowledge of either observer. Considering, however, that the greater number of all these were unquestionably sterile at the beginning of treatment, on account of the morbid condition of the mucous membrane and its discharges, it would seem that the effect is to increase the fertility.

Post-puerperal Metritis; Neglected Subinvolution.—Arrested involution of the post-parturient uterus, whether due to inertia, non-traumatic infection, or traumatic infection, is more successfully and quickly treated by electricity than by any other means at our disposal. It is even a question whether normal involution would not be materi-

¹ See Appendix B.

ally hastened by the systematic application of faradic currents to the highly contractile tissue still constituting the bulk of the uterus, as advised by Apostoli. Certain it is that when the natural process is sluggish by reason of a diminished rate of shrinkage in the muscular fibres a few applications of the faradic current from the primary or a coarse wire secondary coil will stimulate the flagging muscular tissue to develop its normal tone. Sanguineous discharges continuing beyond the normal periods of their appearance, or recurring during the first month after parturition, may be controlled by one or two such applications; and if there is no sepsis or traumatism as a causative factor, no other treatment is necessary. Either the monopolar or the bipolar method may be employed, but the primary current is always preferable.

But it is rare for subinvolution to be of so simple a nature,—shreds of retained decidua, a morbid condition of the endometrium, a laceration or other trauma, being the determining causes of a septic endometritis to which the subinvolution is due. In these cases the galvanic current is indicated with the simple positive pole or with zinc-mercuric cataphoresis if the hemorrhagic feature predominates, though in simple cases the covered elastic electrode is best on account of giving the least pain. The swelling method (gradually increased and diminished currents) should be employed, with a dosage varying from 25 to 60, or more, milliampères. To this the faradic current may also be added.

For a septic condition of the uterus the positive mercuric pole is the most satisfactory, owing to its distinct bactericidal powers, and, if the foul discharge comes from only small shreds of retained membrane or clots, it is quite unnecessary to resort to the risks and loss of blood attending the use of the curette. The drainage that follows a galvanic application will usually be amply sufficient to carry off these shreds when detached by the action set up by the current: but if the placental remnants be large and abundant the dull curette should be used before the alterative and contracting applications are made. In the author's opinion the sharp curette should be abandoned altogether, as its indications are better met in every case by the galvanic current alone.

Hemorrhagic Metritis.—This condition is either due to the retention of shreds in neglected subinvolution or to a vegetative hypertrophy of the mucous membrane of the body (adenomatous endometritis), or finally to hemophilia. Its treatment, except when due to

the last-named condition, yields the most accurate and successful results in the whole range of electro-therapeutics. The writer has never had a case fail to respond promptly to the proper use of the positive pole of the galvanic current, after the method popularized by Apostoli, in which sectional electrodes are used for the purpose of cauterizing the entire mucous membrane of the cavity, step by step. Since the adoption of a mercury-coated zinc electrode, however, he is convinced that time may be gained by its use in place of the carbon instrument. The first applications with any kind of electrode are, nevertheless, likely to induce bleeding, which lessens in amount with each subsequent application. The instrument should always be bare, and the current-strength may vary from 50 to 100 milliampères according to the obstinacy of the case.

Hyperplasia of the Uterus, with or without Cervical Laceration.

—It is by no means rare for the clinician to encounter cases, which, presenting the nervous symptoms of chronic metritis related above, reveal, on examination, an enlarged uterus without notable discharge from the cavity. The uterus, as a whole, may be enlarged, but the hypertrophy is generally limited to the corpus alone, which is indurated, usually retroposed or retroflexed, and only moderately fixed if the appendages are healthy.

Such cases are instances of the later stages of chronic metritis, and will usually give a history of more or less discharge at an earlier period. The cervix, in many such cases, will show a healed laceration, showing clearly the avenue by which the infection originally entered.

It is in this class of cases that Emmett's operation of trachelorrhaphy has been most frequently performed, and some of my cases were instances in which the operation had already been done, without relief of the symptoms or material lessening of the abnormal bulk of the organ. It is, of course, conceivable that this operation may result in a lessened bulk of the uterus by its derivative and revulsive effects, though erroneously performed in a belief that the healed tear was a source of the symptoms; but this is rare excepting when the cervix participates in the hypertrophy.

The true lesion in these cases is unquestionably a degeneration of the muscular substance of the uterus and its replacement by embryonic tissue of sluggish vitality. The ideal treatment is, therefore, one which will stimulate metabolic activities, promote absorption, and favor regeneration of the muscular fibrils. Nothing can equal the

negative pole of the galvanic current for these purposes, assisted by concurrent applications of the contracting faradic current (from either the primary or a coarse-wire, secondary coil). The galvanic current is, by far, the most important portion of the electric treatment, and should be applied in appropriate dose either twice or thrice weekly.

Illustrative Cases.—Mrs. M., aged 31, an excellent instance of the class mentioned in which the general nervous system had resisted the effects of pelvic disease, was admitted to the sanatorium from a neighboring city January 28, 1892. The uterine trouble from which she suffered dated from her first confinement seven years before, and was aggravated by each of two subsequent confinements, the last having been eighteen months before. She complained of sacral aching and a dragging sensation in the pelvis which was aggravated by the erect posture and by walking, rendering her particularly miserable in the evening. Menstruation was regular, but scanty, and the alimentary functions were normal. There had been a history of considerable leucorrhea, but none was now complained of.

Examination showed an enlarged, retroverted uterus with an eroded os and a cavity four inches in depth, exuding inspissated mucus. A spot in the rear of the uterus was extremely tender. She had been wearing a Smith-Hodge pessary, which was removed. Treatment was begun by vaginal alternatives of the galvanic current and the secondary faradic, but it was quickly changed to covered negative intra-uterine applications of 30 milliampères in view of the absence of disease of the appendages, alternating with the vaginal applications. In five days there was a decided relief of soreness; but it was necessary to continue treatment six weeks in the house, followed by several months' office treatment at intervals before complete symptomatic cure. At this time the uterus was normal in size and depth and but slightly retroposed. The completeness of the cure has been tested by five years' observation and one pregnancy without relapse.

Mrs. P., aged 33, was sent to me by Dr. Oaks, of North Ridgeville, Ohio. This case was a good example of the second class of cases mentioned, where uterine disease reacted unfavorably on the nervous system in connection with other depressing agencies. She had been married but four years; but had been in bad health since four years before marriage, which had been sterile. The beginning of the trouble was clearly in a virginal endometritis with menorrhagia dating from puberty, and the gradually-increasing uterine involvement had been

assisted by a neuropathic heredity and the strain of nursing a sick mother. The pain continued very severe at the periods, with scanty flow, and there was vaginismus and dyspareunia. She complained of a neuralgic pain "all over the body" that was most distressing at night. Examination showed the uterus enlarged, retroflexed, adherent, and very tender. The cavity was three and one-half inches deep and exuded considerable muco-pus. The patient was placed on a six weeks' course of intra-uterine negative galvanic applications of 20 to 30 milliampères and the rest cure with general galvanic stimulation, and very shortly showed an improvement in both local and general symptoms, followed by an ultimate restoration of health.

Mrs. C., aged 26, applied for treatment at the Howard Hospital, complaining of weak back and pain in the pelvis. She had never been pregnant, and the leucorrhea, which had lasted for four years, was clearly traceable to one or more attacks of gonorrhea. The uterus was but slightly above the normal size, yet tender and exuding abundant muco-pus. She was placed on positive intra-uterine applications of 20 milliampères once a week and negative vaginal applications twice a week, December 12, 1890. Pain was shortly relieved, and by the following month the leucorrhea had been controlled.

For the table of the ultimate results in thirty-two cases see Appendix B.

Senile or Atrophic Metritis.—The importance of this form of metritis has been particularly shown by Skene.¹ It may be resultant either from a purulent endometritis of earlier years that has been neglected or it may be developed after the menopause. By reason of the lowered vitality of the senile sexual organs this affection is unusually intractable to ordinary methods of treatment, the ulceration of the mucous membrane resulting in its ultimate destruction and of the tissues beneath it also at times. The resemblance to carcinoma is very great in the later stages of erosion, from which it can be clinically distinguished by the leucorrhea being muco-purulent or merely purulent instead of serous, as in cancer.

Goelet has recommended the negative pole of the galvanic current, but my own experience indicates that zinc-mercury cataphoresis is far superior owing to its non-cauterant action and the specially helpful effects derivable from the nascent chemicals released. A less cur-

¹ "Medical Gynecology," page 489.

rent-strength is, moreover, sufficient in the latter case, being proportional, however, to the extent and stage of the disease. Twenty to 50 milliamperes applied to the whole of the affected surface twice or thrice weekly quickly removes all odor and will result in a complete cure in several months.

Metrosalpingitis.—Though it is rare for the physician to encounter an endometritis or metritis in an acutely active stage (unless due to gonorrhea or bad surgery), it is not unusual to be called in a case of acute or subacute salpingitis, either original or recurrent, and in such a case the judicious use of vaginal applications of the bipolar faradic current at the bedside will not only replace opium and other sedatives largely, but materially reduce the extent and duration of the inflammation. Care should be observed not to cause pain either by the insertion of the electrode or by the current, which should invariably be from a long, fine, secondary wire and controlled carefully. The bipolar electrode should, of course, be warmed before insertion, as pointed out by Goelet, the patient lying at ease in bed and well covered, and the application should be prolonged for fifteen or twenty minutes. If distinct relief is experienced (and generally there is a pronounced relief of pain) the application may be repeated twice a day.

Among the conditions closely allied to chronic catarrhal metrosalpingitis and salpingo-oöphoritis are interstitial or parenchymatous salpingitis, purulent salpingitis, pyosalpinx, hydrosalpinx, hematosalpinx, and simple ovaritis, with or without prolapse of the organs. Each of these conditions is, of course, readily diagnosed during or after an abdominal section, but, as the desire of the conservative gynecologist is the cure of the patient without a cutting operation, he is restricted almost entirely to the very probable diagnoses made by an educated bimanual touch in connection with the subjective and other available objective symptoms; and when we reflect upon the high training that may be attained by the skilled finger in detecting the grosser differences between these several conditions, and the fact also that they are all merely different stages and differently situated evidences of the same disease,—inflammation,—it would seem that such diagnoses were amply sufficient for this class of work. If, for instance, the doubt lay between a simple salpingitis or an ovaritis, and the case could be cured by vaginal applications of electricity without resolving the doubt, the patient would surely prefer us to leave the matter uncertain rather than have a dangerous exploratory laparotomy for the

satisfaction of curiosity, even though the curiosity be thoroughly scientific.

In their pronounced stages these several conditions are quite amenable to reasonably correct diagnosis by touch, pointing to certain variations in the electric treatment.

In subacute or chronic metrosalpingitis, evidenced by pain between the periods, tenderness in one or both vaginal fornices, and by a more or less clearly defined enlargement of the tube or by mere bogginess in its region, the treatment must at first be altogether vaginal, both galvanic and faradic, though a moderate galvanic current may be quickly attained. The results in lessened pain and shrinkage of the hypertrophied tissue are soon attested, for the parts are membranous and easily reached by a sufficient density of current, even though indirectly applied. That drainage through the uterus may be promoted, particularly by the negative pole in the vagina, is unquestionable.

This treatment alone can be relied on to secure a practical cure in a considerable proportion of the cases, but the majority will demonstrate that vaginal applications of electricity alone will be insufficient, for the probable reason that much of the original mischief remains in the uterus. When, therefore, a considerable amelioration of the symptoms has been gained by the vaginal treatment, but the progress thus far made does not continue, the uterus being reasonably movable, though with pain, and manifestly enlarged, we should resort to tentative intra-uterine applications without further delay.

The intra-uterine treatment should, nevertheless, be carefully watched, since acute salpingitis or ovaritis or an encysted purulent inflammation of either organ will be made worse by this form of treatment. Increased pain or a recrudescence of inflammation in a pyogenic cavity will often, indeed, attend the mere passage of a sound; but, as recently pointed out by Apostoli, an intolerance of intra-uterine galvanic applications points so unerringly to encysted pus as to become a means of establishing an exact diagnosis. I am myself convinced that we may trench closely upon this debatable ground with every advantage to the patient if precautions be observed to eliminate all harshness of manipulation from the method. If, for instance, a covered spiral electrode only be used, inserted by touch only without the speculum and without drawing upon the uterus or otherwise disturbing its relations to the surrounding tender parts, we may test the

intolerance of the case to electricity itself, which is quite another matter from its tolerance to a more or less brutal handling plus the electricity. The spiral electrode will adapt itself readily and painlessly to any-shaped cavity, and, when employed as a positive pole, which is preferable, will not only inaugurate a wholesale change in the activity of tissue-metamorphosis within the affected structures of the uterus, but ultimately promote drainage from the uterine end of the tube. Less pain is produced also if the electrode be only partly inserted during the first applications.

Twenty milliamperes is ample for a beginning in these tentative applications, repeated every fourth or fifth day, though the daily vagino-abdominal treatment should be continued as usual. The following cases may be cited as examples in which the uterine seat of the affection was still mainly predominant:—

Illustrative Cases.—Mrs. W. F. D., aged 27, entered the sanatorium from a town in the interior of Pennsylvania with a history of continuous suffering since the birth of an only child, eight years before. Instruments had been used at her confinement and she was in bed three months afterward. There was a continuous sensation of weight in the pelvis, a band sensation about the waist, and constant pain in the bladder and ovarian region. Examination showed the uterus posterior-placed, enlarged, and brawny, with a tender mass in the region of the left tube and ovary. She had painful periods and a constant, copious leucorrhea. For two weeks the patient was placed on vagino-abdominal galvanic and faradic treatment and general electric stimulation, with but moderate results. I then determined to test the effect of intra-uterine galvanic treatment, 30 milliamperes, positive, being used with the elastic electrode. Considerable pain resulted from the first application, but before the next day the band sensation had disappeared, and never returned. The intra-uterine treatment was continued twice a week for six weeks, when she returned home practically well. Four years later the permanence of the cure was attested by every evidence of blooming health.

Miss P., aged 24, was suffering from a catarrhal and congestive condition of the uterus and left tube and ovary, traceable to a fall from a hammock sixteen months previously, which had been ineffectually treated by the ordinary methods. The most striking symptoms on admission were weakness in the back, inability to walk far, a sensation described as a burning or itching in the ovarian regions, and a

considerable leucorrhea. Examination showed the uterus enlarged and giving exit to a muco-purulent discharge and the left tube very tender. She was placed on positive intra-uterine galvanic applications of 20 to 25 milliampères to the cavity twice a week, and both currents, vagino-abdominal, at frequent intervals for six weeks, followed by occasional intra-uterine applications for three months longer, resulting in relief of all symptoms and a restoration to health which, at this writing, five years later, remains perfect.

Mrs. W., aged 35, applied at the Howard Hospital October 22, 1895, complaining of pain in the back and lower portion of the abdomen and a peculiar sensation in the top of the head, which dated from two miscarriages and a probable specific infection twelve years before. She had been sterile since the gonorrheal attack. Menstruation had been scanty of late. The condition of the cervix and its discharges are shown in Plate XVIII, having been drawn at the time by the artist. The bimanual examination revealed posterior fixation and moderate enlargement of the uterus with indefinable boggy in the left tubal region. Just before seeing me a colleague in the hospital had given the opinion that a removal of the tubes and ovaries was essential to saving her life. She was placed on negative vagino-abdominal applications of 50 milliampères for three months, during which time there appeared great improvement in the symptoms. The treatment was now changed to cupro-mercuric applications within the uterus of 20 and 30 milliampères once a week for three months. The symptomatic cure was perfect at the end of six months, the patient declaring herself well.

Purulent Salpingitis.—A neglected catarrhal metrosalpingitis, particularly of gonorrheal origin, readily becomes muco-purulent, resulting in a more protracted electric treatment before a cure can be attained by the methods already described. If of long standing, and drainage through the uterine mouth of the tube has been unobstructed, we can readily detect the interstitial enlargement and exaggerated convolutions that have been looked upon as an after-excuse for many unnecessary amputations. Such a condition is as surely curable under positive vaginal applications, assisted by the faradic current and by subsequent intra-uterine treatment, as any similar catarrhal affection elsewhere in the body, the intra-uterine treatment being, of course, carefully employed with a view of increasing the drainage. If, on the contrary, a true pyosalpinx be suspected to exist on account of the

discovery of a cyst in this situation, the case is different. Such an accumulation of the muco-purulent discharge of the tube is usually due to an obstruction at the uterine orifice, and is not an ordinary abscess. In the presence of such a case we are at once confronted by the question of the advisability of attempting the cure of the chronic inflammation by electricity, or of referring the patient to a surgeon for an amputation of the affected part, now having become a

Pyosalpinx.—The determination of the proper course to pursue with this affection is not easy, particularly when we dismiss all mere prejudice in favor of one or the other method from the mind and are guided solely by an enlightened care for the ultimate good of the patient. The considerable number of instances in which apparently closed pus-tubes have been rendered patulous and capable of performing their functions by a combination of vaginal and intra-uterine treatment, coupled with a statement recently made by Dr. J. M. Baldy, an uncompromising advocate of the knife, that many tubes removed for pus accumulation are found to contain none at the time of operation, should all tend to check a too hasty amputation of a yet curable organ. Should the tube, on the other hand, be firmly fixed by well-organized adhesions, and be the seat of an active accumulation of true pus rather than muco-pus, the chances for a cure by the ordinary electric treatment are very remote. As a rule, my own practice is to regard pus-tubes of distinctly gonorrheal origin as inadmissible of cure in this way, and yet the following cases would seem to set aside this conclusion to some extent:—

Illustrative Cases.—Mrs. X., the mother of three children, the youngest of which was three years old, came to me after she had been advised to submit to an operation for the removal of the appendages. Her ill health dated from the birth of the youngest child, but had been much worse for a year past. She had constant pain in the back and pelvis and was so lame in the left leg that walking was difficult and accompanied by an ungainly limp. The uterus was found to be large and exuding considerable foul-smelling muco-pus, and there was a partly-fluctuating lump on either side of the fundus, particularly the left, which could be made out as enlarged and sacculated tubes. After admission to the sanatorium her physician was sent to me by the husband to state that her condition was mainly due to a gonorrhea which she had contracted about a year before. She was placed on the vaginal and intra-uterine treatment described above, the intra-uterine

applications being given with an elastic, cotton-covered electrode, followed by rest in bed for twenty-four hours. At first the cotton was saturated with a foul and bloody discharge after each treatment, but at the end of six weeks there was great improvement in every symptom, and she ultimately regained the power to walk indefinitely without limping and the local evidences of abnormality were greatly lessened.

Mrs. S. J., aged 32, the mother of four children, the youngest of which was 4 years old, applied at the Howard Hospital for treatment August 12, 1889. She had not been well since the birth of the last baby, having had a vulvar abscess when it was three weeks old, and suffering from pain in the back and on micturition, and with a bearing-down sensation since. Menstruation was regular, preceded and followed by an irregular leucorrhea. Examination showed the uterus to be of normal size, pushed forward, and partly fixed by a mass in the left tubal region, which was quite tender. She received eight negative vagino-abdominal applications of the galvanic current during the following month, at the end of which time the pain and lump had disappeared and the leucorrhea was greatly lessened. January 2, 1890, she reported herself three months' pregnant.

Mrs. K. D., aged 28, applied at the Howard Hospital August 27, 1889, complaining of having been unwell since shortly after the birth of her only child, five years before. There were sharp, lancinating pains in the regions of both ovaries, with a sensation of falling of the womb. Menstruation appeared only every other month, and there was no leucorrhea at this time. Examination showed fixation of the uterus and fullness in both broad ligaments. Two vagino-abdominal negative galvanic applications were made, when she reported that there was considerable intermittent leucorrhea. An electrode was now passed within the uterine cavity, finding it three inches deep, and 35 milliamperes, negative, applied. After this had been repeated once a menstruation occurred in the off-month, preceded by an offensive chocolate-colored discharge and followed by symptomatic improvement. Two subsequent intra-uterine applications were made, and the patient reported a profuse, yellow discharge which came on in a gush after the second application. No further treatment was given, as she reported herself as well; the boggiess in the tubal region had disappeared and the uterus was normal in size. December 12, 1889, she

reported at the clinic as still well and in the second month of pregnancy.

It should be repeated, however, that Apostoli, Gautier, Goelet, and other workers are particular to warn against high currents or violent procedures in inserting the electrode in these conditions as likely to precipitate an intolerance to electricity, particularly if the uterine end of the tube is incapable of being opened by a resolution of the inflammation, or if the inflammation is too acute.

In cases incapable of resolution and drainage through the natural channels Goelet strongly urges vaginal electro-puncture and drainage through the opening thus made, provided the pus-tube is low down, adherent, and easily reached through the vagina for aspiration. The recent tendency among abdominal surgeons to avoid the abdominal route of major operation in favor of the vaginal for such cases seems extremely reasonable and in a line with this mode of employing electricity as an adjunct to opening and drainage. He describes the method as follows¹:—



Fig. 29a.—Goelet's platinum cannula-electrode.

"The cut (Fig. 29a) shows the platinum cannula electrode (No. 4, French catheter scale) for the galvano-tapping of pyosalpinx through the vagina. The shaft is covered with an adjustable sheath (A) of hard rubber for insulation. This may be fixed at any point by the screw (B), and the degree of penetration limited. At C there is a three-way stop-cock, and at D a connection for an irrigator, as well as a socket for connecting with the battery. When the trocar (F) is withdrawn, an aspirator may be attached to the rubber tubing (E), and, after the pus has been drawn off by a quarter-turn of the stop-cock (C), the cavity may be flushed with an antiseptic solution passing in at D through the cannula. By turning the stop-cock straight again the fluid is allowed to escape through the tubing (E) into the aspirator-bottle. Care must be observed not to overdistend the Fallopian tube,

¹ "International System of Electro-Therapeutics," page G-116. Philadelphia: The F. A. Davis Co.

the walls of which have been much weakened in some cases. That I may not be misunderstood, I will say that I limit the degree of penetration usually to one centimetre, and deem the procedure appropriate only when the tube is close to the vaginal wall, full, and tense, demanding immediate interference.

"The aspirating cannula is small, penetrates easily, and the insulating sheath can be adjusted, by means of a set-screw, so as to limit the extent of penetration to any degree desired. The method of application is as follows: Having fixed the degree of penetration, the point of the trocar is drawn within the cannula to avoid wounding the vagina or the finger along which the instrument is inserted as a guide. The vagina and vulva are rendered thoroughly aseptic by a douche of creolin or lysol solution, the index finger is inserted into the vagina against the most dependent or prominent portion of the sac, which is held firmly in position by pressure from above on the abdomen (this will not be necessary if the sac is already firmly fixed by adhesions), and the instrument is introduced along the finger and plunged into the sac; removing the trocar, the pus is withdrawn and the cavity irrigated with an antiseptic solution. The cannula is arranged with a two-way stop-cock, which allows this to be accomplished readily, but care is necessary, when the tube is not adherent, to prevent leakage into the peritoneal cavity. The solution should flow from a reservoir of moderate elevation, and much distension of the sac must be avoided. The stop-cock turned in one direction allows an inflow, and a quarter-turn in another direction an outflow, so that thorough irrigation is possible. The penetration of the cannula is limited by the insulating sheath and a set-screw. It is arranged to allow a penetration of one centimetre, but half a centimetre is usually sufficient.

"Before withdrawing the cannula it is connected with the positive pole of the battery and a current-strength of 50 milliamperes is used for five minutes. This pole is preferred because of its well-known antiseptic properties, which are due to the liberation of oxygen and chlorine. Its peculiar reaction destroys the character of the pyogenic membrane and promotes resolution in the sac-walls and surrounding structures. The cauterization of the track of the cannula shuts it off from the tissues which are penetrated, whereby extravasation and absorption of septic material are prevented. When the tube is not adherent the peritoneal cavity is penetrated, but the sub-

sequent cauterization induces an immediate adhesion of the peritoneal surfaces around the puncture, which effectually closes it from outside influences of an injurious nature. Sufficient drainage will ordinarily be afforded through the puncture-track, but, when necessary, it may be facilitated subsequently by passing a small probe or sound-electrode connected with the negative pole to enlarge the track (10 to 15 milliampères will be sufficient). This operation should be performed only at the patient's house, and she should be put to bed immediately after. A loose dressing of iodoform or aristol gauze is placed in the vagina, and renewed every day or two, when a hot douche of a 1-per-cent. solution of creolin is given.

"The subsequent management of the case and the treatment necessary will be suggested by the condition remaining after evacuation of the abscess. Galvanization with the positive pole in the vagina will promote resolution of the surrounding structures, and the negative pole may be employed to hasten the absorption of deposits or soften and relax adhesions which interfere with the necessary mobility of the pelvic organs. Treatment of the co-existing endometritis must not be neglected. It is seldom possible to restore an absolutely normal condition; nor is it attained by the alternative,—laparotomy,—but a condition quite conducive to health, comfort, and usefulness may be brought about. Can as much be said of the radical operation, which deprives the patient of organs essential alike for her usefulness and happiness?"

Hematosalpinx.—This condition is not easily distinguished from pyosalpinx except by its recent appearance. In a thoroughly conducted transillumination of the pelvis a dark cloud will be found in the situation of the tubes in both affections. Hematosalpinx is now thought to be an arrested tubal pregnancy in some cases. Being but an effusion of blood or of blood and mucus, the proper treatment is a promotion of its absorption by negative vaginal galvanic applications, the intravaginal electrode being pressed against the tumor as in the treatment of ectopic gestation. Several weeks' daily treatment with current-strengths of 50 milliampères will usually be found sufficient to cause material shrinkage. In case this fails the method just detailed for pyosalpinx may be employed under antiseptic precautions, though I refrain from advising it. An abdominal section for an accumulation of material so easily absorbed as this is totally unjustifiable.

Hydrosalpinx.—This condition may be approximately distinguished from pyo- and hemato- salpinx by the absence of tenderness and adhesions and by its long-standing character. Under transillumination no cloudiness is observable in the situation of the tumor. Aspiration, followed by a galvanic application to the cavity, will usually insure a thorough cure.

Pelvic Peritonitis.—This condition is usually consecutive to catarrhal disease of the uterus and tubes. The therapeutic management of an acute attack by the ordinary antiphlogistic measures, such as ice, iodine, etc., to the abdominal aspect of the swelling may be

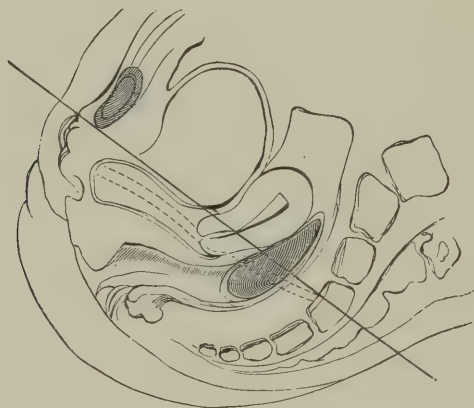


Fig. 30.—Line of rigidity in pelvic peritonitis. (Thomas and Mundé.)

greatly assisted by the use of Apostoli's suggestion of bipolar, fine-wire, faradic applications within the vagina, as in the acute cases of salpingitis and ovaritis. No pain whatever should be produced either in inserting the warmed electrode or by the current, the latter being turned on very gradually and used for fifteen minutes daily, if relief of pain is gained. The cessation of pain by this means can only indicate more or less arrest of the congestive process attending the advance of the inflammation.

In the treatment of the later stages of the acute process the bipolar faradic current is also most useful, to which should be added positive galvanic vagino-abdominal applications in the more chronic

cases. The rapidity with which the exudation forming the board-like vault of the vagina, encountered by the finger in a plane represented by the dotted line in Fig. 30, may be made to disappear under this treatment is often astonishing, even when the agglutination of the pelvic organs is of long standing. The following case is an excellent example:—

Illustrative Case.—A married lady, 37 years old, was referred to me by Dr. J. A. Draper, of Wilmington, Del. She had had a miscarriage seven years before and various attacks of probably specific vaginitis since, culminating in metrosalpingitis and pelvic peritonitis. Under the pain of the latter condition she was fast developing an opium habit. Examination revealed an enlarged uterus set in a hardened pelvic vault just as if plaster of Paris had been poured over it, as described by Thomas and Mundé. She was admitted to the sanatorium on March 25, 1891, and placed on negative vagino-abdominal applications of 75 milliamperes, occasionally changing to galvanic alternatives in the same situation, together with the general rest-cure treatment. By May 5th she was symptomatically well, and my notes speak of great loosening of the uterus, though slight tenderness persisted to the left of the uterus. Several office applications were made during the following month, and on October 2d it is noted that the uterus is quite small and movable, and that no symptoms remain. This lady was seen five years later in the best of health, which she attributed to the treatment received.

CHAPTER IX.

CHRONIC INFLAMMATORY AFFECTIONS OF THE OVARIES.

Chronic Ovaritis.—The unexampled opportunities of studying inflammatory affections of the ovaries after their operative removal, recently enjoyed by the younger school of gynecic surgeons, might have yielded greater good to pathologic science than to some of the patients operated upon had the bucketfuls of specimens brought to the societies been thoroughly studied. As it is, the most important lesson taught by this misdirected energy, aside from its evidence of the cyclonic character of variations in professional opinion, is that ovarian and tubal affections are not easily differentiated from each other prior to operation, and that it is equally difficult to distinguish a curable from an incurable disease of these organs by a simple examination. The great majority of ovaries and tubes thus hastily condemned to extirpation are found after removal to be the seat of simple inflammation, and their unfortunate destruction is a heavy tax to pay for a relatively small number of cases incurably diseased thus discovered.

A means of practically averting this causeless unsexing of women has been recently indicated by Apostoli, the careful application of which should do much to confine castrational operations within their legitimate limits of the removal of useless organs. This consists in diagnostic test-treatments, which, by aggravating the symptoms, make out a clear diagnosis of a condition demanding operation, or by ameliorating the symptoms, indicate infallibly the presence of a curable lesion.

This diagnostic test comprises two procedures: a bipolar faradic application and an intra-uterine galvanic application. If the former relieves the pain at once, or after several sittings, the probability is that the condition is neuralgic or congestive and scarcely inflammatory even. If an intra-uterine application of 35 to 50 milliamperes,

made with a covered,¹ elastic electrode, aggravates the pain greatly and persistently, the possibilities are strongly in favor of a grave inflammation of the adnexa that indicates operative procedures. There is, of course, some discomfort under the second test even in curable cases, and this is more pronounced if the electrode be rigid and inserted with harshness, but the modification of Apostoli's method which I employ, consisting in the use of an elastic electrode, constitutes a most delicate test, as the pain reaction of such an application is at a minimum in cases amenable to electricity.

In my own practice such a test is rarely applied in this way, since I am convinced that many inflammations of the tubes and ovaries are capable of relief by electricity applied by the vagino-abdominal method that would be aggravated by intra-uterine applications. It is only, therefore, when a vagino-abdominal or bipolar faradic application fails to give relief, and a simple vagino-abdominal positive galvanic application aggravates the pain, that a conclusion is arrived at that the condition is one that is impossible to cure in this way; for an intolerance of such treatment surely indicates too advanced a process, with suppurative consequences, tuberculosis of these organs, or other incurable local faults.

As already remarked, the differential diagnosis between chronic catarrhal salpingitis and simple chronic ovaritis is difficult of establishment with absolute certainty, either from the subjective symptoms or by the bimanual examination, but the electric treatment of the minor stages of either condition is practically the same. The treatment, in other words, is directed to the inflammation itself, the current promoting absorption of the interstitial effusion as well as of edematous and serous collections whether situated in the tubes or ovaries. Such a method is necessarily interpoler and but slowly effective in some cases, but the importance of the results that can generally be secured is very great and well worth the time and labor expended.

The applications should be made daily or thrice weekly with both currents, the positive pole of a 30- to 60- milliamperè current being employed for five minutes, followed by a medium or fine-wire, faradic current of the same duration, without removing the electrode. The

¹The use of a covered elastic electrode makes this test more delicate than contemplated by Apostoli, eliminating the mechanical harshness of a stiff sound.

latter should be a carbon or zinc vaginal instrument covered with absorbent cotton, wet and soaped, and gently pressed against the ovary through the vagina. After turning the faradic current off the electrode may be gently shifted to the other side, if both ovaries be affected, and this current again turned on, though it is wisest to reserve the galvanic current in this situation till the next *séance*, alternating the sides for its application. Each application should be followed by repose in bed when this is practicable.

Under this treatment the pain and tenderness lessen and adherent ovaries become looser through absorption of the bands of exudate, the symptomatic improvement proceeding with equal pace with the trophic and vascular restoration. From six weeks to six months will usually be required to attain such results.

A more serious condition is present if the ovaries become prolapsed by reason of increased weight and the dragging effect of adhesions from attacks of circumscribed peritonitis. In this state the wisdom of sacrificing the organs by removal becomes a question of importance, as their dislocated position renders them more subject to relapses and aggravations of the inflammation. It should be remembered, however, that the suffering is entirely due to the ovaritis and other inflammatory conditions preceding and accompanying it, often to a still existing endometritis or metritis, and that if we can restore the parts to a healthy condition in this respect a symptomatic cure may be attained, even though it be impossible to restore the organs to their proper position. The fact that the dislocated position of the organs renders pregnancy unlikely because of the lack of co-aptation of the fimbriated end of the tube to the ovary is no real argument in favor of the removal, as one can never be sure that the tube is not equally displaced and thus capable of performing its functions if rendered free to move. An incurable tenderness or painfulness is the only practical or reasonable indication for castration. That a permanent symptomatic cure of ovaritis complicated by prolapse of the organ may be attained is attested by the following cases, which have been under observation for some time since the cessation of treatment:—

Illustrative Cases.—A young lady, aged 21, was sent to me by Dr. John Chambers, of Kingston, N. Y., May 20, 1892, with the following history: Her mother died of phthisis and her father and a brother of Bright's disease. She herself had always been delicate,

particularly since puberty, which appeared late and irregularly, quickly developing intense menorrhagia. At 18 she was sent to Dr. T. Gaillard Thomas, who inserted a pessary, which relieved her for a time, but subsequently gave rise to much suffering. Returning to Dr. Thomas in 1891, she was placed under treatment at the Woman's Hospital, where oöphorectomy was advised after a period of treatment.

Her general condition on admission to the sanatorium was poor, evidencing malassimilation and some nervous prostration. The principal symptoms of discomfort were, however, directly traceable to the pelvic condition. The sitting posture, and particularly the use of a rocking-chair aggravated the discomfort and pain in the pelvis, which was constant between periods and extreme during the flow. Leucorrhea had been quite bad since the pessary was inserted. The menstrual periods were profuse, with worst pain on first and third days. Examination showed tender and prolapsed ovaries, the left being enlarged and lowest, with enlarged and prolapsed uterus, the latter being near the pelvic outlet and exuding a copious leucorrhœa. The uterine cavity measured three and one-fourth inches. Much pain was developed by the examination.

She was placed on positive vagino-abdominal applications of 50 milliamperes, followed by the secondary faradic current in the same situation and general galvanic stimulation; the applications to be made daily, followed by rest. Great amelioration of the tenderness of the left ovary followed. At the end of the second week a mild intra-uterine positive application with a covered elastic electrode was made, and repeated once in seven days during the remainder of the treatment, which was continued for two months. On discharge her condition was so satisfactory that a symptomatic cure was noted.

In a letter dated February 3, 1896, more than three years after the end of the treatment, this lady reports herself in the best of health, which she attributes entirely to the methods employed. I have unfortunately no notes of the size of the uterus or position of the ovaries subsequent to the treatment, but regard this defect in the record as of less importance than accurate statements of the ultimate result in the restoration of conscious health.

A more difficult case was that of a married lady of 27, referred to me by Dr. Potter, of Germantown, October 25, 1893. This lady was the picture of robust health in spite of an hypertrophied uterus and deeply prolapsed ovaries, the latter being enlarged, tender, and

giving her much discomfort when walking or riding. The trouble dated back to a prolonged labor followed by laceration of the cervix, for which a repair operation had been done by a distinguished surgeon. There was a copious muco-purulent leucorrhea. In spite of the excellent union of the cervix obtained in the plastic operation the uterine body remained hyperplastic, the seat of an unpleasant discharge, and had a cavity measuring more than three inches in depth. The menstruation was irregular, appearing in periods of thirty-one and forty-one days.

Vagino-abdominal treatment seemed to be of little service in this case, probably because the ovaries were not the principal seat of the trouble, though out of place, and it was necessary to attack the uterine trouble by intra-uterine galvanic applications. Owing to the great increase of tenderness evoked by these applications, which were negative and applied by the covered elastic electrode, not more than 35 milliampères were used, and generally less, twice a week, followed by the contracting, primary faradic current to the point of tolerance, then by a bipolar secondary. As a result, the leucorrheal discharge was cured, but when the patient ceased attendance the symptomatic cure and reduction of bulk were still imperfect. It is possible that, had this patient realized the importance of long-continued and regular treatment, as good results would have been attained as in the following case:—

Mrs. J. F., aged 31, applied for treatment at the Howard Hospital clinic May 7, 1896, with the following history: Her only child was 11 years old. Eight years ago she had miscarried and had been an invalid ever since, having had vaginitis of probably gonorrheal origin about the time of the miscarriage. She had received the usual treatment, including pessaries, which gave so much discomfort as to compel their discontinuance, and the advice that her ovaries should be removed was given at several hospitals. There was but slight leucorrhea at this time.

Examination showed an enlarged and flabby uterus, somewhat retroposed, with tender tubal regions and distinctly prolapsed and enlarged ovaries.

She was placed on vaginal positive galvanic applications of about 50 milliampères three times a week. This was continued with great regularity for three months, during which time distinct improvement was noted in both the subjective and objective symptoms. On August

11th the tenderness had so far abated that it was considered wise to begin intra-uterine applications of 40 milliamperes, positive, followed by the fine-wire secondary. This was well borne, and was continued at weekly intervals for three months. In the latter part of January, 1897, the patient had the pleasure of realizing that she was not only restored to complete subjective health, but was also pregnant for the first time in nine years. Her health continued excellent under this trying ordeal, and in October, 1897, she was delivered after a remarkably short and painless confinement.

Ovarian Congestion.—Aside from these marked instances of physical deviations from the normal size and position of the ovaries we have also a numerous class of cases among young women who complain of pain and tenderness in one or both ovarian regions so little accompanied by other evidences of physical disease, such as persistent leucorrhea, as to render a physical examination both unnecessary and unwise. These cases, well described by Skene in his recent work,¹ are but derangements of function unaccompanied by structural changes of the organs, though generally accompanied by congestion or hyperemia. It is usually thought that conditions of life favoring excitation of the sexual function without complete functionation (as in morbidly introspective girls, unhappily married and childless women, and widows) are the principal predisposing conditions, but I have observed the affection frequently where these conditions are replaced by causative factors depending on nutritive disturbances of all the vegetative functions of life, including vasomotor irregularity, constipation, lithemia, neurasthenia, and, of course, hysteria. There can be no question, though, of the tendency of this condition, left to itself, to develop into genuine chronic ovaritis; hence it is important to direct attention to the local condition as well as the general nervous disorder.

Together with a removal of the cause or causes and regulation of the alimentary functions, there is no form of treatment for persistent cases of ovarian hyperemia equal to external abdomino-dorsal applications of both currents accompanied by a judicious course of the rest treatment, inclusive of general galvanic stimulation and massage; provided this be carried out in a properly-regulated institution and away from the accustomed scenes of home and overzealous friends. The

¹ "Medical Gynecology," by Alexander J. C. Skene, page 220. D. Appleton & Co.

rest cure at home is usually thoroughly impracticable in its essential features, and even under the most favorable conditions for its employment it must be associated with the local external treatment described in order that permanent results may be attained. Skill in managing such cases is only attained by physicians who understand that a large proportion of the work in the diseases of women demands a combination of the skill of the neurologist with that of the gynecologist.

CHAPTER X.

FIBROID TUMORS.

PROBABLY the best definition of a fibroid tumor of the uterus may be adapted from Cohnheim as *a localized increase of tissue similar in structure to the uterine body, but the product of embryonic cells of congenital origin, produced independently of microbic causes, and of a benign character*. Spoken of generally in English-speaking countries as fibroids or myofibromata, they are strictly termed fibromas if the fibrous tissue natural to the uterine wall predominates, or myomas if the muscular tissue predominates.

They arise within the wall of the corpus usually, rarely in that of the cervix, and push aside the normal tissues in their growth, being thus encapsulated, and do not blend with or invade the normal tissue as is the case with malignant tumors.

Origin.—The most reasonable theory of the origin of fibroid tumors is that of Cohnheim,¹ who advanced the hypothesis that they arise from a matrix of embryonic cells of fetal origin which have failed to develop into mature cells like those surrounding them. These cells are supposed to have remained dormant during the growth of the general body-structures on account of the physiologic resistance presented by more highly developed tissues surrounding them. Should this physiologic resistance of the environment remain in a normal condition, the remnant of fetal structures continues dormant as a “fetal rest.” Should, on the other hand, this physiologic resistance of the surrounding tissues be lessened by disease, such as a microbic invasion and inflammation, a traumatism, or by the special activities of puberty, the embryonic matrix becomes active and proliferates in accord with its crude endowments, absorbing nourishment from the surrounding tissues and vessels. The tumor-matrix is, therefore, prenatal, and may remain permanently dormant unless afforded an opportunity for

¹ According to Mr. W. R. Williams, in a paper read before the British Medical Association at Carlisle, the theory of the “fetal-rest” origin of tumors was first conceived by Professor Durante, of Rome, Italy, in 1874.

growth by influences that depress the normal inhibiting power of the vital forces.

Effects of Electric Treatment Corroborate Cohnheim's Theory.—This theory of tumor-formation bears many evidences of its truth though essentially hypothetical, not the least of which is the excellent explanation it affords of the phenomena accompanying the electric

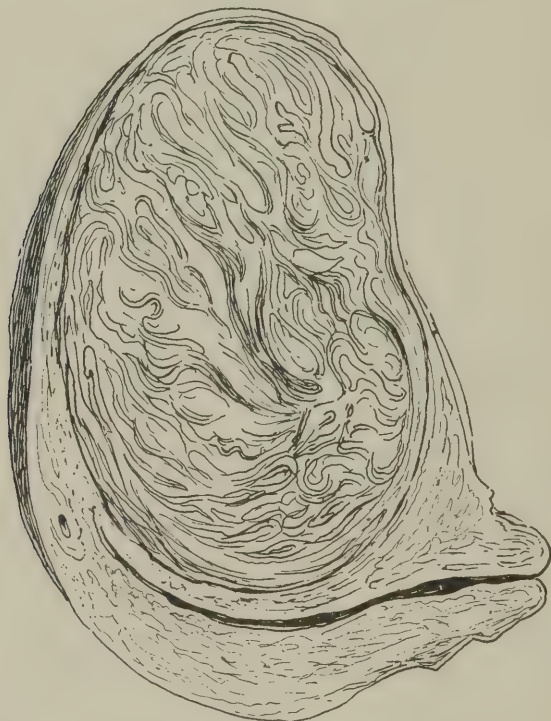


Fig. 31.—Intramural fibroid tumor. (Drawn from specimen in the Mütter Museum of the College of Physicians.)

treatment of these neoplasms. It will be seen that the two elements essential to the existence of a tumor are a matrix of embryonic cells and a released inhibition to their proliferation. That such a proliferating matrix may be checked by a trophic blow transmitted to the matrix by a heavy current, or by an electric stimulation of the physiologic resistance of the surrounding tissues, is quite evident; and that

these are the two modes in which electricity acts upon fibroids, rather than by destructive electrolysis, I have long felt assured.

Clinical Varieties.—A fibroid tumor grows from one or more congenital matrices within the tissue of the uterine wall, pressing the normal uterine stroma before it, and tends to develop most in the direction of least resistance. If this centre of growth appears about the middle of the uterine wall an equable enlargement of that portion of the uterus results, as in Fig. 31, the unaffected tissues being displaced in all directions, giving rise to the most common clinical variety, known as an intramural tumor. If the centre of growth be nearer the mucous membrane than the peritoneal covering it will

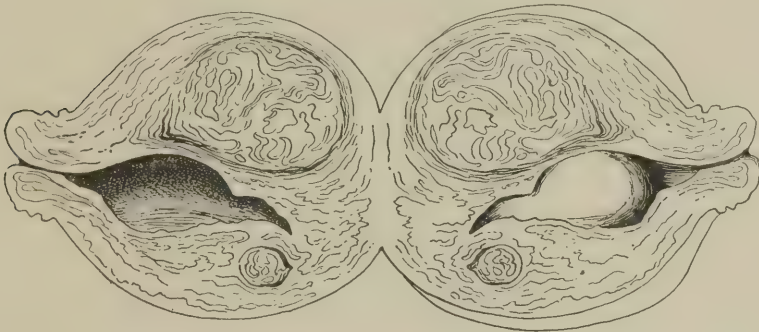


Fig. 32.—Submucous and intramural fibroid tumors. (Drawn from specimen in the Mütter Museum of the College of Physicians.)

in time project more or less into the uterine cavity, forming the submucous variety (Figs. 32 and 33), which may, by still further projection into the cavity, become pedunculated, forming a fibroid polyp (Fig. 34). If, on the other hand, the centre of growth be nearer the peritoneal surface, it will again follow the lines of least resistance, and by projecting into the peritoneal cavity become subperitoneal (Fig. 35), or, by a complete emergence, become pedunculated (Fig. 36).

Whether a given matrix of growth will develop into either of these varieties depends, therefore, on its original situation in the uterine parenchyma and the direction of least resistance to its physical encroachment. In growths of more than one matrix each variety may be found co-existing, particularly the intramural and subperi-

toneal, and an intramural tumor may later take on the characteristics of either a submucous or subperitoneal form as it emerges from either surface.

Certain tumors possess so many matrices of development that the whole substance of the uterus is permeated with the resulting growth, which resembles a symmetrically-enlarged uterus. This variety is known as the interstitial fibroid (Fig. 37).



Fig. 33.—Multinodular fibroid with submucous projections. (Drawn from specimen in the Mütter Museum of the College of Physicians.)

These neoplasms, particularly when the fibrous tissue predominates, are of very slow growth, sometimes existing ten or fifteen years before becoming abdominal in situation and large enough to be felt above the pubic bones. At times, indeed, non-hemorrhagic varieties are not discovered by either the patient or her physician until they have attained a number of years' growth and the size of a cocoa-nut or larger, so slight had been the symptoms of their presence. In other

instances the initial nodules, no larger than a pea, give rise to intense suffering at a time in their history when they remain undiscovered, the patient going through a fruitless succession of attempts to be cured of suspected ovarian disease, displacements, etc.

It is in this initial stage that these tumors are most generally and readily amenable to electric treatment, not only because their small size renders equal currents and periods of treatment more effective than in larger ones, but because all such tumors are, in this stage,



Fig. 34.—Fibroid polypus.

capable of arrest and absorption, while some of them later, by excessive growth, extrusion beyond reach into the abdominal cavity, or degeneration, will become unfit for it.

Any uterus suspected of being the seat of this neoplasm should be promptly placed under the Apostoli treatment therefore, the treatment being continued until the diagnosis is either cleared up negatively by the restoration of the uterus to its normal dimensions and the disappearance of symptoms with the cure of the simple hyperplasia that existed, or until a nodule can be made out by the shrinkage

of the uterine wall surrounding it. In the latter case we are enabled to make a diagnosis of an incipient fibroid with certainty and should continue the applications for a longer period to bring about a still farther retrogression, or a possible disappearance, of the tumor itself. It is fortunate that the applications essential to the cure of simple

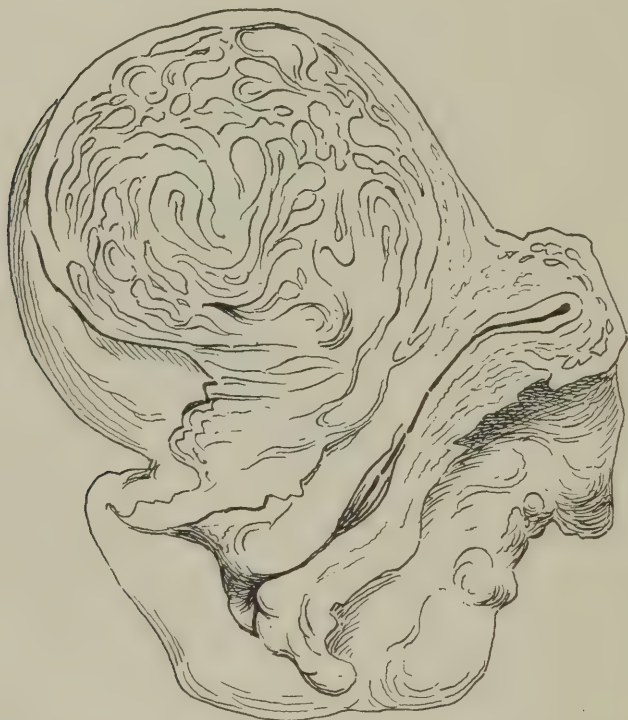


Fig. 35.—Subperitoneal fibroid with sessile attachment to posterior wall of uterus. (From specimen in the Mütter Museum of the College of Physicians.)

uterine hypertrophy and of interstitial or intramural fibroids of small size are identical, being intra-uterine applications of the negative pole of from 25 to 150 milliamperes in non-hemorrhagic cases, or of mercurial cataphoresis of the same strength and locality in hemorrhagic cases. Such an early recognition and prompt remedy of a tedious and troublesome affection, leaving the patient in the complete

possession of both her health and her organs, merits the highest plaudits conferable on scientific skill; but unfortunately the human mind is so constituted as to feel far greater interest in the comparatively gross act of removing a palpably large tumor with the knife, together with sundry organs of precious worth to a normal human being.

Natural Prognosis of Fibroid Tumors Without Treatment.—

Fibroid tumors are essentially and strictly benign and have no connection whatever with malignant growths, though in very rare instances they have been known to become the seat of malignant de-

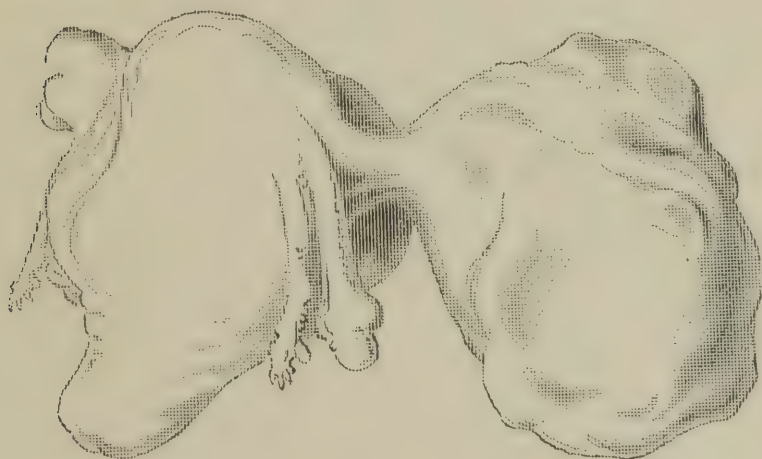


Fig. 36.—Pedunculated subperitoneal fibroid. (From specimen in the Mütter Museum of the College of Physicians.)

generation late in their history. Such a termination is, however, so rare as to be a curiosity. The life of the patient is never threatened, but by some form of degeneration, and it has only recently been appreciated by the profession that the deaths after efforts at removal by the knife represent almost the entire mortality of these growths.

Apostoli's Discovery.—The world is indebted to Georges Apostoli, of Paris, France, for the practical discovery and demonstration that fibroid growths are amenable to electricity, though Cutter, of this country, had used this remedy in fibroids in a crude manner before him and had called attention to its value. Apostoli's modest claim,

first put forward in the early 80's, that electricity will cause a symptomatic cure—arrest of growth and anatomical regression—of a large proportion of such cases without danger, has been verified in all portions of the civilized world, many operators, including the author, going even farther than he originally claimed in reporting actual anatomical disappearance of some growths under their care. The inevitable result of such an announcement has been intensified by the fact that it was made at a time when the early triumphs of anti-



Fig. 37.—Multinuclear interstitial fibroid with one nodule affected by calcareous degeneration. (From specimen in the Mütter Museum of the College of Physicians.)

sepsis were inviting surgeons to added daring in abdominal operations, and hence a most powerful and influential opposition was aroused. Some surgeons, it is true, took it up without sufficient preliminary training to make a success of it, and others after adopting it have frankly confessed that it hurt their more remunerative surgical reputations; but it remains a fact that no single person who investigated the subject in a truly scientific spirit has seen fit to reject it as a most valuable addition to the resources of the curative art. The recent history of this subject has reached such enormous dimensions

that even a cursory review would be out of place in pages devoted to the practical side of the work, and I may merely add that we are indebted most particularly to the late Dr. Thomas Keith, of London, formerly of Edinburgh, the first and most eminent surgeon to successfully remove large numbers of fibroid tumors with the knife, for a most effective plea in favor of a trial of the Apostoli treatment before the performance of any more bloody operations with the knife, and who, in collaboration with Dr. Skene Keith, published a work¹ containing the details of 106 cases so treated. In the introduction to this work these justly eminent surgeons say: "For long we had doubts as to the permanency of the treatment in the early cases. The later work has been much more satisfactory. But now more than two years have passed since all operations were given up for this treatment; and our first patient writes—and no one could have had more hemorrhage—that she has been perfectly well all summer, climbing hills and rowing in a boat. Another of the early and doubtful ones, who could never bear a large dose of electricity, tells us: 'I am now in excellent health, without an ache or pain of any kind, and my periods are just a show, and nothing more, and give me no discomfort whatever. I hope you have been as successful with all your other patients as you have been with me. But it cannot be otherwise, for I am sure that no one could have been worse than I was with that awful hemorrhage.' This patient's importunity had almost driven me into doing hysterectomy for her.

"At first we fell into the natural mistake of trying electricity on every case that presented any symptoms,—in some when the tumors were almost certainly sarcomatous, and even in one who was in the last stages of old cardiac disease. We know now that the cases best treated are those who are suffering much from hemorrhage,—the more, the better,—cases in which something must be done; cases in which, two or three years ago, the question of operation of some kind would have been considered by us.

"This treatment, it must be remembered, is a new thing. We began it in comparative ignorance. Electricity is known by its results, and, working on the living body, progress and improvement are slow.

¹"Electricity in the Treatment of Uterine Tumors, being Part II of Contributions to the Surgical Treatment of Tumors of the Abdomen." by Thomas and Skene Keith, pages 255 *et seq.* Edinburgh: Oliver & Boyd, 1889.

In the following cases, therefore, are found some failures and some imperfect and incomplete cases; the marvel is rather that there are so few. Time and experience every day correct our want of knowledge and diminish these imperfections. No large uterine tumor has, with us, entirely disappeared under the electric treatment, but in four cases of small fibroids, three of which come into the present series, there is not now a trace to be found.

"The carrying out of this treatment faithfully to the end is not an easy matter, and old tumors that are large, and that have bled for many years, take a long time to improve. The treatment runs away with time, and it requires care and thought. To the surgeon, by far the simpler plan is hysterectomy and the removal of the ovaries. But Dr. Apostoli's treatment saves our patient from risk of life by operation, and saves them also from a horrid mutilation,—the one thing that they all dread. We believe it to be the right treatment, and our patients must get it, however great the inconvenience and monotony it may be to ourselves. Though our results after hysterectomy show the lowest mortality of any yet recorded, and though we have had but a single death after removal of the ovaries for fibroid in almost one hundred operations, we reject even the minor operation in favor of Dr. Apostoli's treatment, and we reject hysterectomy altogether on account of the mortality that has hitherto attended it all over the world. The method given us by Dr. Apostoli is good, and it will endure."

In dedicating this work to Apostoli, the elder Dr. Keith, who has since passed to the great majority, leaving with us an ever-living memory of unsurpassed skill, exalted courage, and unflinching honesty, makes some additional statements which might be taken as a final testament of a long and honored career concerning this matter:—

"Since we began your treatment, now more than two years ago, we have ceased to perform any operation on the uterus by abdominal section. For myself, I have always had grave doubts if I were justified in performing such operations at all, especially hysterectomy, for the mortality attending this operation is out of all proportion to the benefits received by the few. As time went on, and the number of operations became larger, my doubts as to whether I were doing right continued to increase, and that, too, in spite of the comparatively low mortality with which I was favored, more especially in my private practice. I never had any such doubts as to the propriety of perform-

ing ovariectomy, for, if ovarian cysts be left alone, death is almost certain, and even that is only reached after great suffering. With hysterectomy it is quite different. Hysterectomy is a hazardous operation for the removal of a tumor that, of itself, rarely shortens life. The minor operation, on the other hand,—the removal of the ovaries,—requires no surgical skill for its performance. It is a great mutilation to a woman, being simply castration; and women are beginning to find this out. It is not always successful in attaining its purpose, for you will find in these pages some cases narrated that were cured by electricity where operations on the ovaries had failed to give any relief.

“Your method thus came to me at a very opportune time. You have taken away from me those anxious doubts and fears that had so long vexed me. For long I had hoped much from electricity in the treatment of fibroids, but had only met with disappointment till your method was made known to me. It is in every way a new method, and it belongs to you and to no other. You have worked in the true scientific spirit. For five years you labored quietly at your clinic, kept up at your own expense, and open to all, before you made your work known. When it was made public, and ought to have had from all a warm welcome, or at least a patient hearing and honest investigation, considering the magnitude of your work, it was received with unbelief and ridicule. In common with many, I regret the unfair treatment you have received in this country. In spite, however, of the ignorance and prejudice displayed, your work is every day making its way, and it is impossible to resist the accumulating evidence there now is in its favor. That you will, in a few years, see your treatment adopted all over the world I have little doubt.”

The prophecy contained in the last sentence, quoted from Dr. Keith's work, has long since been fulfilled.

Mode of Action of Electricity.—Much misconception has existed as to the mode in which electricity is expected to act in these tumors, the original impression with many, uncorrected in the previous editions of this work, being that the purpose of the applications was the physical, electro-chemic decomposition of the tumor-substance. This, of course, can be done with a sufficient current-volume, but it would be followed by the formation of a sloughing mass of dead tissue surrounding the electrodes that would be dangerous in tumors situated within the body, as these are. What does happen as a result of the use

of currents of far less volume and duration is a shrinkage of the tumor *en masse*, no greater shrinkage occurring in the parts nearest the special seat of application or puncture than in those situated most distant. It appears, therefore, that the nature of the response is essentially trophic, the passage of currents of sufficient volume through the tumor causing an inhibition of the proliferating power of its abnormal cells, followed by a retrograde metamorphosis, quickened tissue-waste, and absorption through the lymphatics and veins, particularly the former, with which these growths are abundantly supplied. Coincidentally with this direct action upon the lowly organized embryonic tissue of the tumor, it is certain that an increased physiologic resistance of the healthy surrounding tissues (trophic stimulation) is promoted by the passage of the electric current, and, as the most plausible theory of the growth of these tumors involves a lessening of this resisting force as a primal cause, its stimulation must be essential to a cure.

It will be seen that the essence of this discovery of Apostoli is that electricity may be used to arouse the natural forces of the body to remedy a faulty cellular growth by simply reversing the conditions that made the growth possible. The absorptive powers of the tissues are well known, even unstimulated by electricity,—bone, cartilage, and tumor tissues aseptically buried in the flesh being readily disintegrated and removed; hence it is clearly seen that the most important element of the electric treatment is the *reversal of the formative conditions* of the neoplasm. The task of the physician is the selection of the cases in which this can be done and the determination of the dosage and methods requisite for each case.

The reduction in the size that follows shortly after commencing a treatment adapted to the special case results, also, in a progressive relief of the pain, tenderness, and other pressure symptoms due to the growth. This early relief of pain and pressure symptoms must be partly due to the shrinkage alone, the nerves and organs that had been stretched and pressed upon being capable of adapting themselves to a still abnormal condition by reason of the partial relief afforded; but much of the symptomatic improvement must be due, also, to an electric stimulation of the physiologic resistance opposing the growth, as evidenced by a lessening of any surrounding inflammation, restoration of pelvic and abdominal tone, and even increase in the thickness of the abdominal wall.

In addition to the arrest and retrogression of the growth and the relief of pressure and inflammatory symptoms, an even more important and equally certain result is the cure of the hemorrhagic symptoms that attend so many of these cases. This hemorrhagic tendency, which sometimes assumes alarming proportions, is due to one or both of two characteristics: either a fungous endometritis (adenomatous degeneration of the endometrium) or to an hemorrhagic tendency of the tumor itself. That curettage is useful in correcting adenomatous degeneration is unquestionable, but it exerts no control over what might be called the essential hemorrhagic tendency of a fibroid; hence is far inferior to electricity as an hemostatic in such cases. The slowly-produced effect of mercurial cataphoresis is, moreover, more certainly and permanently curative of the fungous condition even than curettage, by reason of the more effectual eradication of the matrices of the growth. To effect this the electrode must be most thoroughly applied to all portions of the endometrium by the sectional method devised by Apostoli, in which a bulbous anode as large as can be inserted is carried to the fundus, and, after a suitable application there, is withdrawn a distance equal to the length of the active surface and the current again turned on, the procedure being repeated until the instrument again reaches the internal os on the way out. The hemostatic effect will be heightened if the additionally alterative action of a zinc-mercury electrode is employed as active pole instead of platinum or carbon. In hemorrhagic tumors the action of electricity is, therefore, dual, the local effect on the endometrium being hemostatic and the inhibition and shrinkage of the growth being antihemorrhagic.

Selection of Suitable Cases.—All fibroid tumors in the early stages of their growth are suitable cases for this treatment, unless, indeed, where electric treatment in the pelvis is contra-indicated by reason of a purulent collection within this cavity. The presence of such a contra-indication is, however, infallibly announced by an aggravation of symptoms after the first few applications, and in the absence of this post-applicative reaction it may be confidently assumed that all tumors not yet emerged from the pelvis are amenable in a high degree to both symptomatic cure and anatomic arrest and lessening. Of tumors so large as to have emerged from the pelvis and become abdominal in situation greater care in selection is requisite before promising the best results, for it should be remembered that neither Apostoli nor other authoritative writers have claimed that all

cases are equally amenable to electricity. After they have attained this size the intramural variety is most amenable to both amelioration and cure, though there are a certain number of smooth, monocentric fibromas of ball-like contour and firm texture that yield very slowly to anatomic change, even though they may be classed as interstitial or intramural because of a distinct situation within the uterine wall. In most of these slowly-responding tumors of this character the uterine cavity is found stretched upon one side of the growth, the opposite wall being attenuated. When the cavity is more nearly central, and there are evidences of several foci of growth giving rise to a multinodular surface, the case is a most favorable one for marked diminution as well as symptomatic cure.

Distinctly submucous tumors are also suitable cases, the current arousing the contractile action of the encompassing muscular fibres as a re-enforcement of the special denutritive effect, and such tumors are thus brought further into the uterine cavity, becoming more pedunculated.

Subperitoneal tumors, particularly when pedunculated, are not easily reached by effective applications unless imprisoned in Douglas's pouch, when they may be brought under the electric influence by vaginal puncture through the median line of the posterior wall of the vagina. When a subperitoneal tumor is very large and abdominal in situation, and lying directly beneath the abdominal wall, abdominal puncture by the method described on page 138 may be used.

Contra-indications.—Fibrocystic tumors, or unusually soft myomas, contra-indicate the intra-uterine and puncture methods, and the same is true of all fibroids complicated with acute or purulent lesions within the pelvis or with abdominal ascites. Non-purulent inflammatory troubles in this region also contra-indicate both of these methods at first, but do not contra-indicate vaginal treatment, under which they may so far improve as to make the more vigorous methods subsequently admissible. A successful case of destructive electrolysis of an intra-uterine fibrocyst is described on page 158, but the method employed was totally distinct from the Apostoli treatment, and the excellent result attained does not, therefore, controvert these conclusions. Unless we are in a position to dissolve and drain away the fibrocyst under full antiseptic precautions, as was possible in this case, the ordinary effect of electricity in promoting tissue-change is detrimental in the presence of the clogged lymph-spaces and deficient lymphatic circulation that is peculiar to this form of degeneration.

Methods.—Bearing in mind, on the one hand, that the current should be concentrated as near as possible to the matrix of the tumor, and, on the other, that it is not always necessary to produce a lesion of the mucous membrane in an inaccessible locality, it follows that the best methods in the majority of cases are: either intra-uterine applications with as large an active surface within the uterus as can be inserted, or vaginal puncture. It has not been my experience that vaginal puncture offers any quicker results than the intra-uterine treatment in interstitial or intramural tumors with accessible cavities, and I reserve it, therefore, for cases in which the intra-uterine treatment is impracticable or is clearly inefficient by reason of the growth being subperitoneal.

Intra-uterine Applications.—The intra-uterine method is therefore the method of choice in most cases, both for theoretic and empirical reasons, and is the method particularly associated with the name of Apostoli. Its employment for fibroids does not differ in technique from that described on page 59, to which the reader is referred, the special directions for the treatment of hemorrhagic cases being given on page 84. An important detail to be observed is to employ as large an instrument as can be inserted, in order that the local action shall be equally applied to the cavity. In many cases we are compelled to rely on the rigid sound-shaped electrode (Fig. 24), because nothing else can be inserted. This instrument, like all others used, should be properly curved, asepticized, and the insulation¹ renewed and carefully inspected before each insertion, the shellac or sealing-wax being carried down to a point that will bring the bare surface entirely within the internal os to avoid the formation of late atresias. Whenever it can be inserted I, however, prefer to employ the cotton-covered elastic platinum electrode (Fig. 25), or in hemorrhagic or endometritic cases a suitable size of the zinc-amalgam electrode (Fig. 26), as positive pole, for recent experience has aroused a strong suspicion that the nascent oxychloride of mercury and zinc is of additional service in promoting arrest and absorption of the growth. When employed it should be freshly amalgamated previous to each application, to favor as great a dissemination of the mercury as possible. This necessitates the invariable employment of the posi-

¹ Shellac or sealing-wax fused on the shaft.

tive pole,¹ even in non-hemorrhagic cases, it is true, but the denutritive effect is certainly greater than with the simple negative pole, besides the comfort to the physician of the knowledge that he is employing a most powerful antiseptic agency coincidently with the arresting treatment *per se*.

Vaginal Puncture.—Reserved for subperitoneal tumors of pelvic situation, or interstitial growths with inaccessible cavities, this method



Fig. 38.—Apostoli's vaginal puncture trocar, for use with handle shown in Fig. 23.

should only be employed through the posterior vault of the vagina owing to the near situation of important structures in other portions of the pelvis. Apostoli originally employed for this purpose a large trocar with a shoulder limiting its insertion to either a half or one centimetre, the vagina being protected by a movable sheath of hard rubber or glass; but since 1892, possibly owing to the author's advocacy of a completely-insulated puncture-track, or buried puncture, in

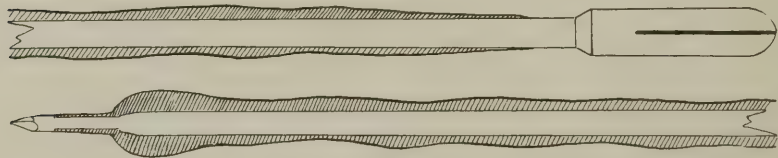


Fig. 39.—Author's vaginal puncture trocar (enlarged sectional view).

the earlier editions of this work, he employs the trocar shown in Fig. 38, with the sheath and handle shown in Fig. 23. The latest model of the author is shown in Fig. 39, in which the limiting shoulder of Apostoli is added, but the insulation is fused freshly for each application on the shank of the trocar itself, doing away with both the tube and the awkward edge of insulation, which hinders easy insertion, and

¹ This instrument may, of course, be employed as a negative electrode if desired; but no diffusion by cataphoresis then occurs.

securing *absolute* asepsis. As the author invariably employs the negative pole, the instrument is preferably made of steel.

The insulation is of hard rubber, a stick of which is set on fire and applied to the heated instrument while burning, the coating being then re-fused and made smooth in that way. When done carefully, the coating is continuous back of the bare surface at the point, the small shank in front of the shoulder being brought up to the diameter of the point by its thin coating, which continues back over the shoulder on to the main shank without break.

The instrument being thus freshly aseptized, as well as insulated, the vagina is douched with a bichloride or other antiseptic solution, and with the patient in the dorsal position, the hips resting on a firm table or operating-chair, the instrument is inserted with the point resting in the palmar surface of the index finger, thus shielding the vagina. Reaching the projecting portion of the tumor at a spot previously determined on, the point is carried forward and pressed firmly into it through the vaginal wall, an assistant meanwhile steadying the tumor from above. When the full insertion is made and the abdominal pad placed the current is turned on until it registers between 100 and 200 milliampères, negative. The duration of the application is the same as within the uterus.

The act of puncturing the vagina gives rise to considerable pain, but most women are easily able to bear it, and the subsequent action of the current is no more painful than in the intra-uterine applications, if the active surface of the electrode is carried well beyond the mucous membrane. Some of my punctures have been made under anesthesia, but I prefer to do without general anesthetics, when practicable, on account of full anesthesia being necessary to obviate the troublesome movements of a partially anesthetized person. While withdrawing the instrument the finger should be pressed against the vaginal wall alongside of it as a support, the insulated portion having a tendency to stick fast. Antiseptic douches will usually be the only after-treatment required, in addition to rest and hot applications for the relief of pain, should it appear. In case the puncture is made in the physician's office the patient should be sent home in a carriage.

These punctures may be made as frequently as three times a month. I have myself made them twice a week for a time, a slightly different spot being selected on each occasion; but when employed so frequently the physician should be on the lookout for a local reaction,

which should be the sign for a cessation of the treatment until it has subsided.

Buried vaginal puncture will reduce fibroids and remove pain when the intra-uterine method is not tolerated. I have, moreover, never had a mishap or bad effect from its use, though this may be attributable to a careful selection of cases, as I can well conceive that the procedure might result in injury to important organs if employed in any case other than those in which the tumor is accessible by virtue of a practical protrusion into the posterior vaginal vault.

Abdominal Puncture.—Where the tumor is so large as to be abdominal in situation and not readily reached through the cervical canal or by vaginal puncture I have found it expedient to puncture through the abdominal wall by a method that I devised and described before the American Electro-Therapeutic Association before learning that the late Dr. Freeman, of Brooklyn, had employed a somewhat similar method in a cruder form. The fact that Dr. Freeman never published anything relating to his work had left the subject of abdominal puncture of fibroids represented in literature only by the exceedingly crude and unscientific work of the early '70's, when uninsulated electrodes resembling bayonets were used, with which the unfortunate patients were transfixed. To the bayonets was attached a battery consisting of a single cell. The infinitesimal current that was used in this harsh method, coupled with the fact that the work was done in the preantiseptic times, caused a mortality altogether out of proportion to any good results, and has given a bad name to abdominal puncture that is totally undeserved. These tumors are beneath our hands when they have risen entirely into the abdomen, with only the abdominal wall and two layers of peritoneum intervening. As contrasted with the pelvic route, scientific puncture from this direction is free from the embarrassing neighborhood of important organs if no intestines are in the way, is direct and exact, but possesses the one disadvantage of being intraperitoneal. By the expedient of employing only insulated electrodes to protect all tissues above the tumor the two pricks made by the needle in the peritoneum heal immediately, and in several hundred punctures made by me by the method described below there has not been a single instance of untoward results of any kind, and no evidence that any puncture resulted in adhesions.

The details of the procedure as devised by the author are as fol-

low: The punctures being invariably negative, small steel needles are used, three at each puncture, attached by branch wires to a single pliant copper wire as a conducting cord (Fig. 40). No. 22 or 24 insulated wire is much more convenient than an ordinary conducting cord. For the puncture needles there can be no better form devised than the straight Hagedorn surgical needle found in every instrument-shop. These needles possess the advantage of great ease of penetration, combined with lightness and strength, and the slit puncture made by them admits the increased bulk of the covering without hitch. This slit form of puncture also heals easily without a scar. The needle should be about three inches long, the first half-inch from the point being left bare and the remaining portion covered with hard rubber vulcanized on the shank as thinly as consistent with good insulation.¹ It is easily attached to the copper wire by the latter being passed through the eye and wound around the shank in contact

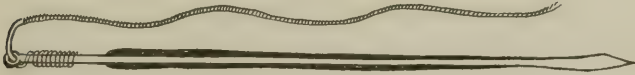


Fig. 40.—Author's abdominal puncture needle (shown in enlarged section).

with the metal. With the patient lying upon a large pad attached to the positive pole, these needles, properly insulated, sterilized, and attached to the negative pole of the battery by the branched wire, are easily and painlessly thrust into the tumor through the skin, the surface having been previously rendered surgically clean. Just before the insertion of each needle the spot selected should be anesthetized by a chloride-of-ethyl or rhigolene spray. The current-strength has varied in my punctures between 60 and 200 milliamperes, and the duration from six to eight minutes. After the removal of the needles the minute spots made are sealed by the application of collodion. As to frequency, it is probably best to allow at least one or two weeks to elapse between each application of electricity in this manner,

¹The insulation and reinsulation should be done before each puncture, by the physician himself, to insure asepsis from heat and soundness of the covering. Melted hard rubber from an old thermometer-case set on fire will adhere to the needle if the latter is heated.

although this depends on the size of the tumor and the field of tumor-surface accessible to the method. It need scarcely be said that no punctures should be made at any spot that might be covered by intestinal convolutions.

The immediate inconveniences that follow these punctures, such as tenderness and pain, are generally less than those following an intra-uterine application. As a measure of precaution, some patients under this treatment have been kept in bed in the sanatorium or hospital for twenty-four hours after each puncture, but others have been punctured at the hospital or clinic and walked home shortly afterward.

Vagino-Abdominal Applications.—Danion, a former pupil of Apostoli, has made the claim that mere vagino-abdominal alternatives are both sufficient and superior to the intra-uterine and puncture methods in the treatment of fibroids. This is unquestionably a mistake as a broad claim, for the greater resistance of the tumor-tissue compels the bulk of the current to pass around it when the active electrode is not within its substance. That this method may act effectively upon some tumors is nevertheless certain, and the author had, in fact, used it long before the claims of Danion came to his attention. It is indicated as the proper treatment whenever the more active methods are for any reason inexpedient or contra-indicated, as when there is more tenderness in the ovarian regions than would render intra-uterine treatment wise; when periuterine congestion or an old pelvic peritonitis with adhesions overshadow the tumor in the production of symptoms; or when the patient is so advanced in years or so feeble as to render more active treatment unwise. It may be also used with advantage in the intervals between the days of more active treatment.

In employing the alternatives the ordinary vagino-abdominal method is varied by leaving the electrodes *in situ* after turning the current off, reversing the polarity at the commutator, and then turning the current on again in the same gradual manner, repeating the procedure a number of times with a current-duration each time of about a minute. The advantages of this method are: greater contraction of muscular fibre by reason of the variation of potential being exactly double what it would be with the same current-strength without reversal, and a protection of the vagina from erosion, since the electrolytic action is nullified in each reversal. Its disadvantage compared with simple vagino-abdominal applications, which are, at times,

preferable, is that the actions of electrolysis or cataphoresis are practically wanting.

Results of Treatment by Electricity.—A method designed for the relief of human ailments must stand or fall on its ascertained results alone, no matter how plausible may be the theory or hypothesis on which it is founded or explained. Tested by this rule, electricity in the treatment of fibroids has more than fulfilled the modest claims of Apostoli, for a much larger proportion of cases has been completely removed by absorption than was at one time thought possible, the extent of the original claims being merely a symptomatic cure and anatomic regression. Adhering to the rule of personal experience adopted in previous editions of this work, a tabulated list of eighty-six cases of fibromyomata of the uterus consecutively treated is given in Appendix A, the results in many of which are stated at periods varying from two to ten years after the cessation of treatment. On analyzing this table the following results appear:—

Cases resulting in anatomic and symptomatic cure:	
(a) Destroyed piecemeal by electrolysis through cervix.	1
(b) Extruded through cervix in whole or part.....	4
(c) Disappeared by absorption.....	12
Cases resulting in symptomatic cure:	
(a) With great reduction in size.....	16
(b) With slight reduction in size.....	21
(c) Without change in size.....	10
Total cases resulting in practical success.....	64
Symptomatic improvement only.....	4
Failure to effect any change.....	6
Made worse.....	1
Total cases resulting in failure to relieve.....	11
Ultimate results unknown.....	11
Total cases.....	86

In computing the percentages of these results it is but just that the eleven cases in which the ultimate results are unknown should be eliminated from consideration on account of the fact that these cases

were all dispensary patients who received but little treatment, it being, in the absence of definite information, as likely that this little relieved their pains and thus caused them to be careless about returning as that the results were only negative. Deducting these leaves seventy-five cases in which the results are sufficiently definite for statistical purposes.

The sixty-four successful cases give, therefore, a percentage of 85.33 per cent. of successes, and the eleven cases of but slight improvement, or no improvement, give a percentage of 14.66 of failures.

The one case that was made worse was a cystic intra-uterine growth that was improperly treated by electricity very early in the history of this method and before it was generally known that such cases should not be treated by the now classic intra-uterine method. Future statistics will naturally be clear of this source of error, as well as those arising in attempts to favorably affect subperitoneal tumors that are inaccessible to direct applications. And, even if no improvement be made in these figures in the near future, it is a distinct satisfaction to the conservative physician to reflect that in the 15 per cent. of cases in which electricity does no good it can be relied on to do no harm in proper hands, leaving the tumors unchanged for the trial of other methods. The slight responsibility in advising electric treatment is evident.

On the other hand, the question is a far different one when the surgical removal of these growths is considered. With a mortality of one in four in the most skilled hands¹ the physician assumes a serious responsibility who advises a resort to this method before the value of electricity has been tested in the case.² There is no appeal from surgical failure. It should be the court of last resort.

And, while lack of space forbids a complete discussion of the relative disadvantage of other methods, it may be said that a marked

¹ Pozzi ("Clinical and Operative Gynecology," American translation, volume i, page 310) gives a percentage of 25.80 of deaths in a list of 345 operations in the most skilled hands.

² A distinguished surgeon, now deceased, advised an operation in one of the author's cases. On being appealed to whether he would not have electricity tried if she, the patient, were his daughter, he at once assented and referred her to the writer, who has had other evidences that a higher conception of advisory responsibility prevails among physicians when members of their own families are involved.

contrast exists also between the cases successfully treated by electricity and surgery. Successful removal of the tumor necessitates removal of the ovaries also, thus destroying the distinctively feminine characteristics of the individual; produces a weak spot in the abdominal wall leading to hernia, which is practically far worse a tumor than the original fibroid; and in some cases produces painful neuroses due to cut nerves, and even at times insanity. No such sequences attend the electric treatment, which invariably restores the patient to robust health and almost as invariably checks further growth of the tumor, even in cases where more or less of the tumor remains after treatment as a harmless lump of flesh.

Fifteen of the cases contained in the table deserve a report in full,—namely, the twelve cases that disappeared by absorption; one case that is tabulated as extruded in part but the bulk of which disappeared by absorption; one case treated by abdominal puncture with notable results; and one case tabulated as destroyed piecemeal by electrolysis.

Case No. 1.¹ An unmarried lady of 45, a patient of the late Prof. William Goodell, who had diagnosed a fibroid tumor four years previously, was admitted to my private sanatorium February 11, 1888, suffering from general impairment of health due to a tumor (Fig. 41), about 5 x 3 inches in dimensions, developed from the right wall of the uterus, apparently in the broad ligament. As there was a sharp turn in the upper portion of the uterine cavity it was thought at first that the tumor was broadly pedunculated, but subsequent exploration of the cavity proved that it extended a considerable distance to the right, and that the growth still formed the right wall of the uterus, which it had pressed very much to the left. As a downward prolongation of the growth could be easily felt close to the right vaginal wall it was punctured in this situation and 150 milliamperes, negative, applied. This was repeated four times, with a resulting diminution in the projecting portion of the tumor. Three years subsequently the patient came under observation again with a continuance of menorrhagia and no reduction in the upper limit of the growth. Under improved technique an electrode was now passed four and one-fourth inches to the fundus and a series of positive intra-uterine applications made, varying in strength from 30 to 100 milliamperes, the tumor becoming pro-

¹The numbers refer to the tabulated list contained in Appendix A.

gressively smaller. The patient reports, recently,—over ten years after the punctures,—that she is unable to find any sign of it and is in perfect health.

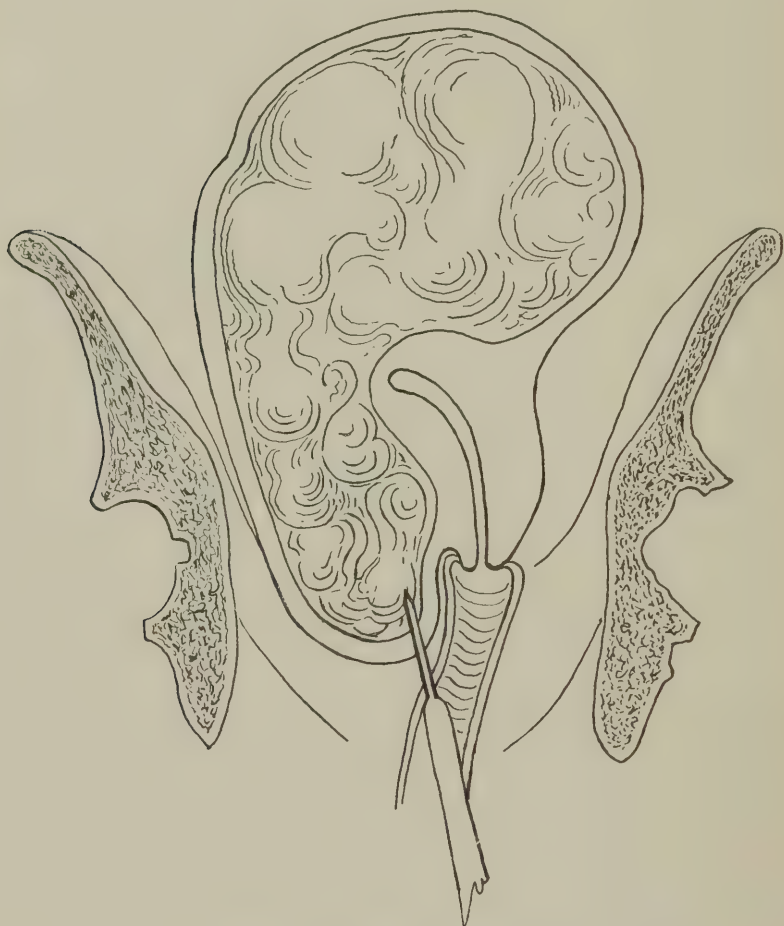


Fig. 41.—Diagram of original outline of tumor in Case 1.

Case No. 5. A married woman of 38 was kindly referred to me for electric treatment by Dr. T. Hewson Bradford, of Philadelphia, early in 1888, at the Out-Patient Department of the Pennsylvania Hospital, at a time when clinical material was very valuable in testing the then

novel statements of Apostoli. The growth consisted of a hard, irregular, multiple mass occupying the lower half of the abdominal cavity, a central nodule extending two inches above the navel (Fig. 42). The main portions of the tumor lay to the left of the median line. The os was patulous, but lay so high in the vault of the vagina as to be reached by the finger with difficulty. Menstruation was regular, but profuse, and attended with severe pain at the beginning and end of

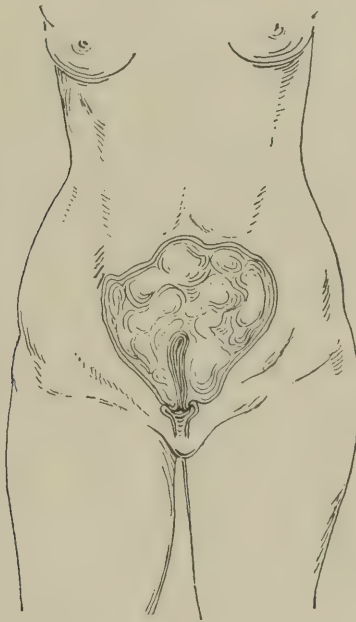


Fig. 42.—Diagram of original outline of tumor in Case 5.

each period. Owing to pressure, walking was difficult, and there was much swelling of the legs and feet.

The treatment was at first by the negative pole, as this was early in the application of the method, with currents varying from 60 to 150 milliampères, resulting in some uncomfortable sanguineous flows; but after five applications at appropriate intervals a distinct lessening of size was noted, enabling the patient to wear dresses as much as four inches smaller at the waist. The improvement continuing, the patient

shortly after ceased treatment and took a position as cook in a large family. Eight months later there was a return of pain and tenderness without increase in size, and, as it was desirable that rest should follow each application, she was admitted to the house department of the Howard Hospital and treated for six weeks with currents of 250 milliampères. At the end of this time she could lie on the stomach for

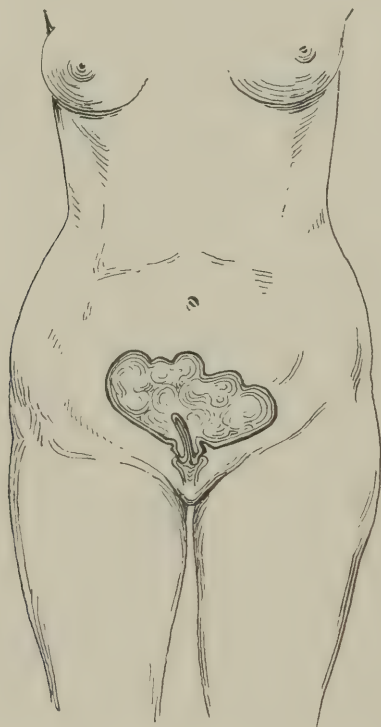


Fig. 43.—Diagram of original outline of Case 6.

the first time in years, and the upper limit of the tumor was two inches below the navel. She was seen five years later by one of the hospital nurses, to whom she declared that the tumor had entirely disappeared.

Case No. 6. A single woman, aged 41, was referred by Dr. Frank Woodbury, with a history of hemorrhages twelve years before, at which

time the tumor was first discovered. The menorrhagia had ceased for some time, but she was troubled with menorrhagia and a most offensive leucorrhœa. The pelvis and lower third of the abdomen were filled with an irregular, hard mass, extending nearly to the navel, and separated by deep sulci into three lobes (Fig. 43). The os was found with difficulty, but was so stenotic as to foil all attempts at inserting a sound or electrode. An unsuccessful attempt was made to insert a steel needle into the tumor through the abdominal wall, developing

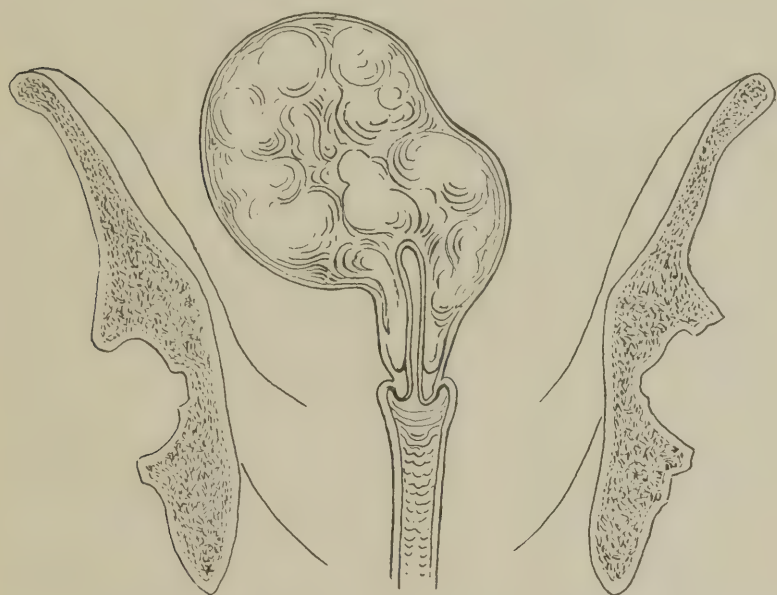


Fig. 44.—Diagram of original outline of Case 7.

the fact that the tumor had undergone calcareous degeneration in its upper portion. A filiform sound was now passed two and a half inches into the cavity and 60 milliamperes applied successfully. Two days later a No. 18 wire, tipped with solder, was inserted, and a week later an ordinary sound, by which time the odor had disappeared from the discharge and never returned. The treatment was kept up for six months, as it was seen that a diminution was taking place, at which time her condition was as follows: General health much improved,

no leucorrhea, no menorrhagia, cavity of uterus normal, and tumor shrunken one-third. Instead of being three-lobed it now consisted of three distinct tumors, movable upon one another, showing that the absorption had doubtless occurred in the base where there was probably no calcareous change. She reported to Dr. Woodbury recently that the tumor had disappeared.

Case No. 7, referred by Dr. Bradford, presented an interstitial enlargement of the uterus to the size nearly filling the pelvis, in a patient 34 years old. There was a subperitoneal projection on the right the size of a large orange, extending up into the abdominal cavity to a level with the anterior superior process of the iliac bone (Fig. 44). She suffered from a copious purulent leucorrhea and constant pain in the left groin, rendering walking difficult. The treatment consisted of intra-uterine negative applications, beginning with 50 milliampères and quickly increasing in subsequent applications to 150. Symptomatic improvement began very shortly and reduction in size was noted in the second month. The treatment was kept up about eight months. Examination subsequently showed a reduction of the uterus to normal and of the protuberant portion to a nodule no larger than a marble.

Case No. 13 was the wife of a physician in a Middle-Western State, aged 48, and was sent to the sanatorium by the late Professor Goodell as not suitable for operation. She was having alarming hemorrhages almost constantly, which kept her in daily fear of a fatal issue. The tumor was very large, fully as large as an adult head, and of the smooth, hard, monocentric variety, the cavity being spread out on the right side with an extremely thin wall on one side and a depth of five inches (Fig. 45). It had evidently developed in the left wall of the uterus and became submucous, but so large as to spread the organ out on its right. Treatment was commenced at once with a carbon electrode of large size, which was pressed into the tumor rather than applied to different portions of the cavity, as in sectional cauterization, on account of the very thin right wall. The hemorrhages being alarming and the patient more than usually impatient, the treatment was pushed most heroically,—some twenty-two treatments in fifty-five days: about every other day, since a period intervened during the applications. Nearly all of these applications were of 250 milliampères for the long durations of ten and fifteen minutes. As the hemorrhages were now arrested, she went home, but the natural

result of a tedious separation of a portion of the tumor resulted, with slight rise of temperature. After this part came away the remainder of this large tumor slowly disappeared by absorption, and the patient, when heard from, ten years later, in March, 1898, was in perfect health, not a vestige of the tumor remaining.

Case No. 17. This patient, a multipara, aged 34, was seen at the Howard Hospital, July 29, 1889, with an hemorrhagic fibroid



Fig. 45.—Diagram of original outline of Case 13.

filling the pelvis and extending above the level of the iliac bones. The upper portion was readily felt through the abdominal wall, being hard, somewhat flattened in shape, and with an irregular surface (Fig. 46). As the hemorrhage had lasted this time nearly two weeks, treatment was begun at once with a positive intra-uterine application of 110 milliamperes and continued twice a week for two months. By September 27th, on which day the last application was given, 70 milliamperes strong, the tumor was almost gone, her color was improved,

and she was gaining flesh. As she did not return again to the clinic, she was specially sent for on December 12th, and the following note made after examination by several physicians present: "Examination shows no evidence of tumor. The only abnormal conditions present are a thickening of the cervix on one side, some fixation of the uterus, and slight leucorrhea. She states that her periods are regular, lasting but three days."

Case No. 20. This case, a patient at the Howard Hospital, aged

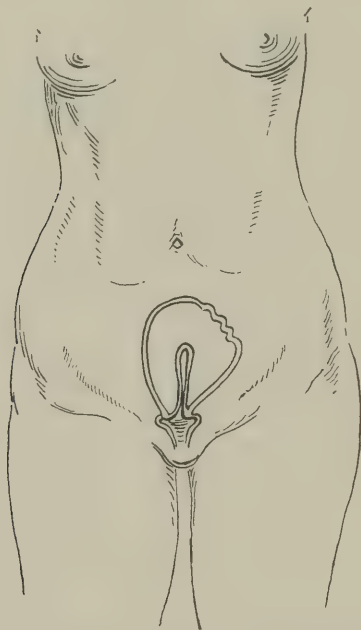


Fig. 46.—Diagram of original outline of Case 17.

30, presented a singular history, the exact stages of which are left somewhat indefinite, owing to her limited intelligence. On examination, August 12, 1889, the uterus was found so large as to nearly fill the pelvis, with a nodular outline at the fundus. The os was virginal and the cavity measured three and one-half inches. She had been complaining of painful hemorrhages every three weeks for two years. An intra-uterine application of 60 milliampères positive was made, and nothing further seen of the patient for over four

months, when she returned, saying that it had caused pain twenty-four hours later, followed by a sanguineous discharge that continued three months, two weeks of which had been spent in a hospital. Still complaining of pain and leucorrhea, an examination showed that the tumor was much reduced (it is probable that a portion had been extruded). She was now placed on vaginal applications, which resulted in complete symptomatic cure by January 31, 1890, the leucorrhea being gone and the periods regular and painless. The hospital notes of this date say: "No sign of tumor except lumps in tubal region."

Case No. 22 was also seen at the Howard Hospital, September 18, 1889, with a fibroid tumor situated in the right wall of the uterus about the size of a goose-egg and giving a history of a year's duration, with irritable bladder and other pressure symptoms. The treatment was intra-uterine negative applications of 60 milliamperes. Two months later there was considerable reduction in size. The notes say, under date of November 1, 1889: "Examination shows uterus quite small and movable; no evidence of tumor." This condition was found to persist a year and a half afterward on the patient being visited at her home.

Case No. 24. This lady, a widow aged 41, presented a typical instance of a small, bleeding fibroid situated in the posterior wall of the uterus so near the cavity as to give rise to alarming hemorrhages out of all proportion to the size of the tumor. At her periods she stated that she lost as much as some do in child-birth. Two years previously she had passed a polypus, and the hemorrhage, pain, and tenderness had persisted since then, becoming worse of late. The fibromatous uterus was much enlarged, with a projection on postero-lateral aspect and a cavity three and one-half inches in depth.

The treatment of this case lasted exactly three months, being positive intra-uterine applications of a usual strength of 100 milliamperes with platinum electrode (the zinc-amalgam method not having then been devised), and resulted in the complete cure of the pain and hemorrhages, disappearance of the tumor by absorption, and reduction of the cavity to two and one-half inches. Her general health, which had been much impaired by loss of blood, was completely restored.

Case No. 35. This lady was sent to me by Dr. Davis, of Bridgeton, N. J. She was 50 years old, and had been suffering from profuse and irregular menstruation for some time, but the tumor was not

discovered until Dr. Davis found it to be the cause of an attack of retention of the urine. When admitted to the sanatorium,—October 17, 1890,—the uterus was found to be pressed against the pubes by a hard growth attached by a broad pedicle to its posterior aspect, and extending from a level of the os to within two inches of the navel. Another nodule was the size of a walnut and freely movable (Fig. 47). The cavity was over three inches in depth. As the bulk of the tumor was subperitoneal and the lower end was easily accessible through the posterior vaginal vault, the treatment was by buried vaginal

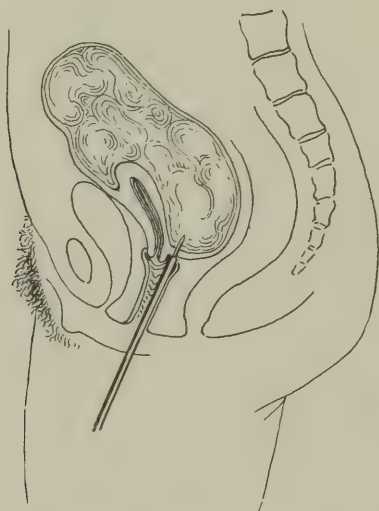


Fig. 47.—Original outline of tumor in Case 35.

puncture, negative, the needle being inserted from one to one and one-fourth inches beyond the vaginal surface. The punctures were all negative, and varied in strength from 100 to 150 milliamperes, no anesthetic being required. In all, ten punctures were made, a diminution in size showing after the second. At the final puncture,—March 2, 1891,—the highest point was four and a half inches below the navel,—a reduction of two and a half inches in longitudinal diameter. On May 17th of the same year she returned by request, saying that it was impossible to feel any tumor through the abdominal

wall. This was verified, no growth whatever being ascertainable by external palpation. The bimanual showed only a slight roughness at the fundus (Fig. 48). At the present time, seven years after admission, her health continues perfect, so far as the tumor is concerned.

Case No. 38. This case is particularly noteworthy in presenting the history of complete disappearance of the largest tumor that, so far as the author is aware, has been caused to disappear by electrically-induced absorption without the assistance of the menopause. The lady in whose case this gratifying result has occurred was a widow

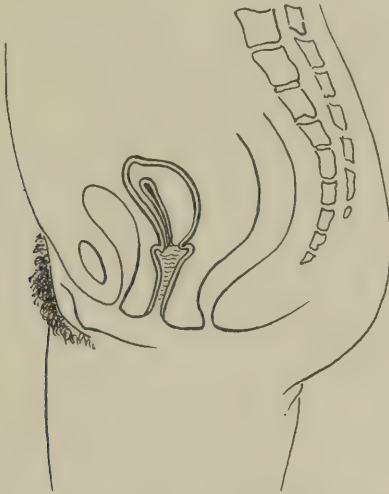


Fig. 48.—Outline of tumor in Case 35 after treatment.

46 years of age, though since her restoration to health she has married a second time. She was first seen by the author on January 31, 1891, having been kindly referred by Dr. G. H. Whitcomb, of Greenwich, N. Y. The growth was at that time about the size of an adult head, the upper limit about one and a half inches below the navel, hard, knotty, and freely movable in the abdominal cavity, in which it mainly lay (Fig. 49). Examination showed it to be continuous with the uterus, the cavity being in the anterior portion, distorted, and difficult of penetration; large projections extended to the right and

left posteriorly. The patient said the growth had been discovered but three years before, though preceded by the intense menorrh-spasms from which she still suffered. One year before seeing me she had been placed under electric treatment by Dr. Whitcomb, whose intelligent application of the Apostoli method resulted in great relief of pain and a reduction of size from one and a half inches above the navel to the same distance below that point. The treatment had been discontinued for some time before the case first came under my observation, but since her removal to Philadelphia there had been a recur-

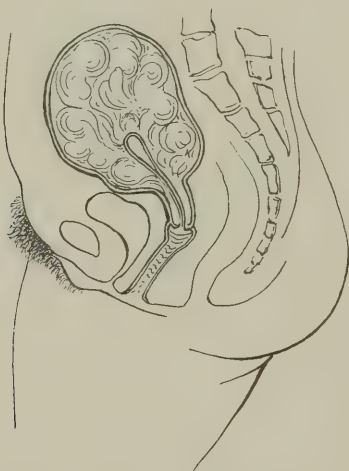


Fig. 49.—Original outline of tumor in Case 38.

rence of menstrual pain and swelling of the tumor, and she was also suffering from an edematous swelling of the right leg. The examination showed that the posterior projection, which was of more recent appearance, probably caused the edema by mechanically interfering with the venous circulation of the leg.

She was placed on vaginal alternative applications of 150 mil-liampères and subsequently on a weaker intra-uterine dosage. In three weeks' time she was able to lay aside the elastic stocking that she had been wearing. During the following month, however, a typical attack of the prevailing influenza put her back somewhat, and I

was afforded an opportunity of witnessing an example of the intense menorrhspasms with which she had been afflicted, accompanied by a swelling of the tumor to the level of the navel again. The treatment was, nevertheless, persisted in, and I had the satisfaction, some months later, of noting a great reduction. At the end of six months' treatment she was seen again by Dr. Whitcomb, who had some difficulty in finding the tumor. Six months later it had entirely disappeared (Fig. 50).

The case was examined recently by the author, and but for an abnormal hardness of texture and a slight projection the size of a

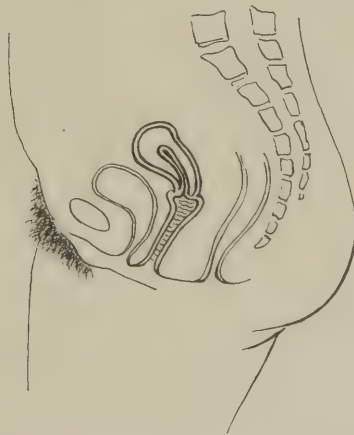


Fig. 50.—Outline of uterus in Case 38 after treatment.

split almond from its posterior aspect, the uterus could not be distinguished from a perfectly normal one. The enormous, irregularly lobulated growth had disappeared. The patient menstruates normally five days at a time, and without pain; showing that the result was not assisted by the menopause, which has not yet appeared.

Cases Nos. 42 and 76 complete the list of tumors that disappeared by absorption, and are sufficiently described in the table.

Case No. 46. Mrs. C. M. W., aged 45, was brought to the sanatorium by her husband on March 20, 1891. She was a nullipara under the average height, and the immense size of the tumor, in con-

junction with a lateral curvature of the spine, produced a most noticeable deformity. The tumor had been known to exist for fifteen years and had been accompanied by hemorrhages, the latter having ceased on appearance of the menopause six months ago. The menopause had not been of service in ameliorating the condition of the patient, except in the matter of stopping the hemorrhages, for her health was becoming worse and the tumor had made a distinct increase in size during the intervening six months.

The growth was somewhat larger than the uterus at term, ex-

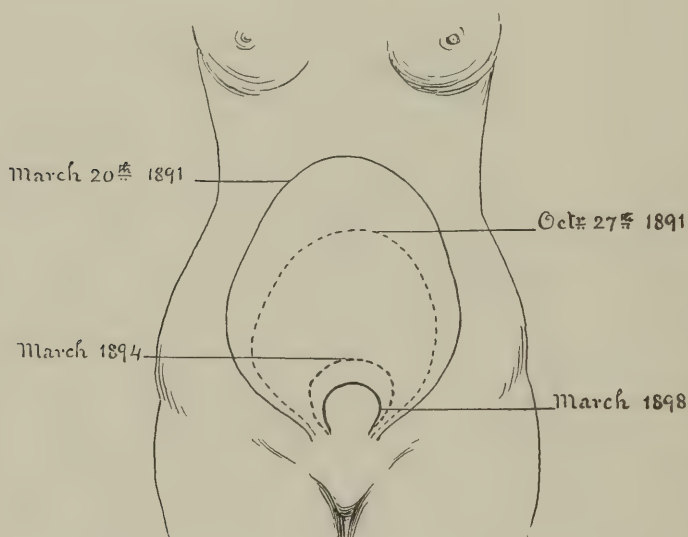


Fig. 51.—Outlines of tumor in Case 46 at various dates.

tending four and one-fourth inches above the navel and increasing the abnormal waist measure to thirty-seven and one-half inches. It projected so far as to measure eighteen and one-half inches from spine to spine of the ilium (Fig. 51).

On palpation the tumor seemed so elastic that I at once suspected a semicystic nature. This was rendered more probable by the symmetrical and ovoid shape of the growth and the fact that the cavity could not be entered by a sound to a greater depth than three inches, the cervix being effaced. Under these circumstances my de-

cision was announced that the Apostoli treatment would be inapplicable, and the patient was urged to consent to a consultation with a surgeon, the husband being sent for for that purpose.

The lady, nevertheless, positively declined surgical treatment and begged me to do what I could with electricity. To determine the true nature of the growth it was decided to aspirate it through the abdominal wall. This was done on March 29th, withdrawing one and one-eighth ounces of a serous liquid that coagulated on standing. On microscopic examination by Dr. Alfred Stengel, of the University Laboratory, it was pronounced a mixture of blood and fluid from a broad-ligament cyst, though no proof of the latter was found. A second aspiration one month later withdrew two ounces of the same character of fluid. The fact that this liquid came from small cavities successively pierced by the needle was not out of keeping with other clinical evidences that the growth was a fibromyoma undergoing cystic change and increase in size, and the cavities seemed to be separated by trabecular processes. But probably the most distinct proof of its myomatous nature was afforded by subsequent evidence that showed that it would temporarily diminish in size under strong percutaneous currents.

These punctures for diagnosis having been so well borne and so easily made, owing to the absence of any structures between the tumor and abdominal wall, it was now determined to employ negative abdominal punctures after the method described on page 138. At the first puncture 60 milliampères were used with three needles. Three days later the measurements were three and three-fourths inches above navel, and seventeen inches between iliac spines; the circumference was not taken. This showed some diminution. The punctures were now made regularly at periods not less than two weeks, the current being gradually increased to 150 milliampères. On October 27, 1891, the tumor had decreased to two and one-half inches above navel, fifteen inches between spines, and thirty-five inches in circumference,—a very notable decrease in all measurements. The patient was also in greatly improved health.

The patient now came from her home in New York City for a puncture about once a month, the current-strength being from 200 to 300 milliampères, by triple puncture. The last puncture was made March 14, 1893,—two years after the first. In June of this year the tumor was even with the navel and the abdominal circumference was

but thirty-two inches, in spite of much additional flesh in consequence of improved health. The patient continuing under occasional observation since the cessation of treatment, I have been able to add to the measurements in the cut (Fig. 51) that taken in March, 1894, when the upper limit was one and one-half inches below the navel and the circumference thirty and one-half. At the present time the growth requires careful palpation to detect it and the patient is in perfect health.

Case No. 61. Mrs. W. A. D., a nullipara, aged 39, was sent to

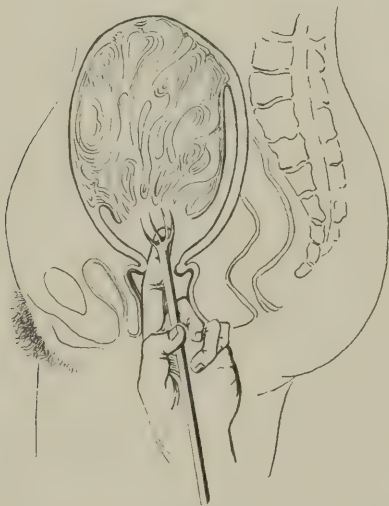


Fig. 52.—Original outline of tumor in Case 61, showing method of treatment.

the sanatorium on September 29, 1892, by Drs. Hemminger and Bixler, of Carlisle, Pa. The growth had been discovered by Dr. Hemminger seven years before. On admission the uterus presented a symmetrical enlargement about equal to the fifth month of pregnancy, elastic and semifluctuating in consistency. Through the dilated os a smooth elastic body presented, nearly the size of a child's head. This was the lower portion of a vasculo-cystic intra-uterine tumor that was found to be everywhere adherent to the interior of the uterus except around the internal os and for a small space an-

teriorly. The presenting portion projected about an inch beyond the external os; similar projections had been removed by Dr. Hemminger on two previous occasions by means of the *écraseur*. The patient complained of but little pain, but was disturbed by a most copious watery discharge and was much reduced in health.

The cystic nature of this growth clearly contra-indicated the ordinary Apostoli treatment, and after considerable hesitation it was determined to try a new method of electrolytic destruction with a bipolar instrument made especially for the case, each pole terminating in a needle-point about half an inch long, the points being immovably

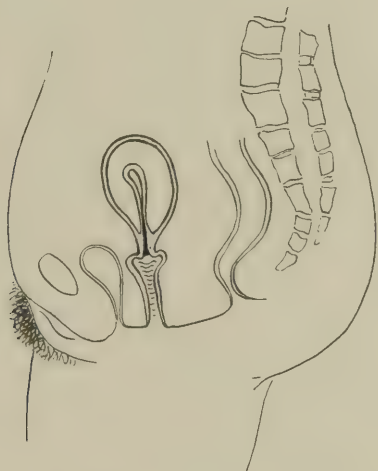


Fig. 53.—Outline of Case 61 after treatment.

fixed a half-inch apart. Before beginning this the *écraseur* was applied to remove the most projecting portion. This proved both difficult and dangerous, the material being exceedingly tough and the hemorrhage so frightful as to cause an abandonment of the operation. The electrolytic method (Fig. 52) was now begun, and 300 to 400 milliamperes employed for ten to fifteen minutes daily, without sensation to the patient other than slight internal warmth, followed by continuous irrigation with a weak solution of permanganate of potassium. As much as 700 milliamperes was later employed, resulting in a material reduction by actual destruction of growth at

each sitting, the uterus contracting as the material was dissolved. Not a drop of blood was lost. This treatment was kept up more or less actively for six months, or until May 9, 1893, when the following note was made: "Tumor all gone except base attached to anterior surface of cavity. The cervix admits but one finger. Other nuclei of fibroid growth are now shown to exist in the walls of the uterus, which remains longer than normal, but no larger than a small pear."

An examination, made in the summer of 1896, showed a still further diminution in size of the uterus (Fig. 53) and the patient in good health.

This case inaugurates a new method of treating vasculo-cystic intra-uterine tumors that are accessible through the os, and it is a method that has several advantages over both morcellation and hysterectomy, the advantages over the former being its bloodlessness, the fact that septic absorption is rendered difficult by the electrolytic sealing of absorbents at the junction of the destroyed and undestroyed tissues, and the highly antiseptic nature of the products of electrolysis with so strong a current. Its advantage over hysterectomy is that the patient may get rid of the tumor and be restored to health without losing any of her organs, even the uterus.

Aseptic precautions are, of course, essential to this method of treating a cystic intra-uterine growth; but, when the immensely antiseptic effect of 300 to 700 milliampères is considered, it amounts mainly to a problem of keeping the cavity aseptic between treatments.

This was done in this case by placing the patient on a rubber bed-pan and douching the interior of the uterus with a gentle stream of strong, permanganate-of-potassium solution, maintained continuously for an hour, twice a day. Nothing less thorough would have preserved her from infection. The harmless nature of the solution employed enabled the injections to be kept up for months.

The method is only possible when the cervix is dilated, as in this case.

In addition to my own cases thus summarized briefly and tabulated fully in Appendix A, I shall add a classification of the results reported by the Keiths in the volume referred to, as arranged by myself, for the authors of this most interesting narrative of case histories did not classify the results themselves, but apparently left this to be done by their readers.

Author's Classification of the Results in 106 Cases Reported by Drs. Thomas and Skene Keith:—

Cases resulting in anatomic and symptomatic cure:

(a) Extruded through cervix in whole or part. 3

(b) Disappeared by absorption..... 3

Cases resulting in symptomatic cure:

(a) With great reduction in size..... 47

(b) With slight reduction in size..... 18

(c) Without change in size..... 5

Total cases resulting in practical success..... 76

Symptomatic improvement under insufficient treatment 8

Symptomatic improvement only..... 13

Total cases resulting in partial success..... 21

Failure to effect change..... 6

Made worse..... 2

Result unknown..... 1

Total cases treated.....106

The present status of the Apostoli treatment of fibroid tumors is not completely shown without a reference to articles by Drs. Grand and Famarque, Dr. Apostoli's assistants in Paris, and by Dr. J. H. Kellogg, in the "International System of Electro-Therapeutics."¹ I reprint also a more recent and most interesting paper, read before the American Medical Association, at Baltimore,² by Dr. Lapthorn Smith, of Montreal, who was one of the first to employ the method in America, and who did more than any other to render it popular in this country by translations of the writings of its originator and by numerous papers of his own. Dr. Lapthorn Smith's testimony is the more valuable, nevertheless, as the judgment of one who, in addition to being a skillful user of the method, is a surgeon by choice and by reason of a large practice.

¹ "International System of Electro-Therapeutics," edited by H. R. Bigelow. Philadelphia: The F. A. Davis Co., 1894.

² Journal of the American Medical Association, August 10, 1895, volume xxv, page 226.

"At the full flow of the tide of the most successful surgery the world has ever known, one must possess a good deal of courage of his convictions to rise in the presence of such a distinguished audience as this to even discuss, far less to advocate, the treatment of tumors, even the most benign, by any other method than the surgeon's knife.

"Appearing on the programme of this meeting, surrounded, as this paper and its author are, by papers and surgeons advocating every kind of surgical treatment, from tying the uterine arteries to removing nearly all the pelvic contents, my position is a peculiarly difficult one; the more especially as I have been trained as a surgeon and now occupy a position as surgeon in several hospitals, where I am often compelled by circumstances to treat fibroids by surgical procedures.

"It is only fair that I should say at the outset that I did not choose this topic for my discourse; it was assigned to me by our esteemed chairman, who, in order to preserve the high reputation for impartiality which has been possessed to an eminent degree by the chairmen of this section of the Association in the past, no doubt wished that justice should be done to all methods of treatment at present employed. So strong is my own personal taste for surgery, especially of the abdomen, that I might have been tempted to disobey the chairman's command but for one reason, which was that as I reflected upon my work during the past seven years there passed before me the images of some fifty women whom I had treated for fibroids by electricity: first, as they appeared when I saw them, with faces anxious with pain and blanched from hemorrhage, and then after their pain had been relieved and their bleeding had been stopped by galvanism and their cheeks had resumed a rosy hue; these fifty women's faces encourage me to do justice, though the heavens may fall, to the treatment which has cured them.

"Then there pass before me the dying faces of *ten* women who were treated by total extirpation, at two of which operations I was the executioner; at six of which I was first or second assistant, and at two of which I was only a spectator.

"True, the majority of the ten operations were performed in the preantiseptic days, though by a great master in this department of our art; but four of them were performed within the last few years under the most rigorous aseptic precautions by men who have a small mortality in general for abdominal surgery.

"The memory of these fifty women who have been cured by electricity, many of whom I could find, if required, and many of whom to this day stop me in the street to thank me and it for their rosy cheeks; and the memory of those ten women who are now no more, all tell me that I would be a traitor to the cause of truth if I remained silent, not only out of season, but in the very hour when it most needed to be spoken.

"True, I can quiet my conscience when circumstances compel me to operate, by the reflection that one woman died while under electric treatment, not through electricity, but through an error of diagnosis, for mistaking a tense, impacted, liquid tumor for a fibroid, which would not have been made if the abdomen had been opened, or, in other words, if the treatment had been surgical instead of electric. This is the one and only case in which, as far as my experience goes, I have ever had to seriously regret the use of electricity.

"I can still further soothe my conscience when I am compelled to operate, by remembering that I have operated on ten women, seven by abdominal hysterectomy, treating the stump by leaving it trans-fixed at the lower angle of the incision; and on three by removal of the appendages, tying the ovarian arteries low down; and several others treated in the latter manner, at which I was assistant, all of whom recovered and are now in good health.

"When I visit the City of Brotherly Love, where the surgeons have declared war to the knife upon the electrode, I am often placed in an awkward predicament. When I tell my friend, Dr. Joseph Price, that I am going to spend a few hours at the electric clinic with Dr. Massey, he is surprised that a man of my intelligence can waste his time in such fiddle-faddling nonsense, and it is useless for me to assure him that I can show him many women in Canada, from Manitoba, in the west, to New Brunswick, in the east, who are pictures of health, and who have been cured by electricity.

"On the other hand, when I tell my friend, Dr. Massey, that I am going to spend the morning with Dr. Joseph Price, extirpating fibroids, he looks with pity on my blood-thirsty taste and misguided energy.

"In vain I tell him life is too short to treat all my fibroid cases by such means.

"In this somewhat peculiar position which I occupy, I have one consolation, and that is, or, at least, I hope that it will be so, that the

conclusions which I shall presently lay before you are those of one who is entirely unbiased and non-partisan, and are consequently to be accepted, as far as they go, in good faith.

"My own opinion on the present *status* of electricity in the treatment of fibroids is fully made up, and I shall now endeavor to lay it plainly and honestly before you.

"During the last year especially, although it has been growing gradually for several years, the conclusion has become evident that electricity is not suitable for every kind of case nor for every kind of doctor.

"But it is as true to-day, as it ever was, that, for the cure of pain in, and bleeding from, the uterus, the application of the positive pole of the galvanic current, properly applied and of sufficient strength, to the uterine mucous membrane is, in the majority of cases, effective. The percentage of successes is greatest in those cases in which the fibroid growth is interstitial; not quite so great in the cases of sub-mucous growths, although in several of these cases a few applications have been followed by the expulsion of the tumor from the uterine cavity. The earlier the cases come under treatment, the more surely they are cured, many patients with small interstitial tumors in the anterior wall having been completely cured by me, and still more under the care of others; so that the plea for the early treatment of fibroid tumors by electricity is quite as just a one as is the early plea for operative treatment. Indeed, it is even more so, for, while we can truthfully say that the electric treatment, when undertaken early and with a correct diagnosis, is at the present day entirely devoid of danger, no one can truthfully say the same of the treatment by operation. In fact, I am sorry to say that no one knows what is the death-rate of the latter treatment. Three of the ten deaths which I have above mentioned have never been reported, and six of them were only reported at my urgent solicitation.

"May there not be many other similar cases? When a woman comes to a doctor for menorrhagia and he discovers a small fibroid, is he to urge her to submit to an operation, when he knows with the greatest skill and care she runs the risk of dying from the operation, and, if left alone, the death-rate is no more than 1 per cent., while with electric treatment the risk is absolutely nothing?

"When she tells me that she will not submit to an operation,

shall I assure her that I can do nothing for her, when I carry in my pocket the record of fifty similar or worse cases which have been cured by electricity? Surely, that were dishonest. And yet the temptation to operate, in spite of the danger of surgical and the safety of electric treatment, is very great,—too great, in some cases, for us to resist.

“Ours is a busy life, and there is not one of us here who has not often felt that life was far too short to accomplish all the good that we would wish to do, and, for the want of a few more hours in the day, much work of value to our fellow-beings must go undone. With this feeling strong within us, a poor woman applies at the out-patient department of our hospital with a small interstitial fibroid which has, however, doubled or trebled the bleeding surface of the uterine mucous membrane. We believe that we could cure her by a long and tedious course of treatment with electricity, from ten to fifty applications; if there are no facilities at the hospital, then at our office. If at the hospital, the time required for this case would seriously encroach upon the time allotted to our service there; if at an office there is the same, as well as other, objections. And when we have made the sacrifice and cured the woman, what is the reward? Perhaps, but not always, the woman’s thanks. Our own feeling of having done well, surely. But when we turn to our brethren, whose esteem is and should be the greatest incentive that we can look for, to good work, well and conscientiously performed, what do they say? We have no fresh and bleeding tumor to take to the medical society (as an Indian waves a white man’s scalp), before our admiring brethren, as a trophy of our prowess and our skill. I have shown the women over and over again; I have shown their clothing which had to be taken in, as much as seven inches, owing to the decrease in size; the women themselves have offered to state on oath that their bleeding had been arrested, their pain removed, and their general health improved. How were these triumphs of therapeutic skill received? With loud applause, you will say. No, indeed! The praise bestowed upon the exhibitor of even an apparently healthy appendix, the removal of which was followed by the death of the patient, is wild in its enthusiasm, when compared with the manner in which is received the report of a case of cure by electricity. Indeed, a sincere friend and admirer in our society warned me privately that my reputation was injured every time I showed a woman who had been cured by this means, and he urged me to show no more. But I must continue

to cure them by that means as far as my time-limit and life-limit will allow.

"How different when we report an operation, whether the patient lives or dies. Everybody seems pleased and praises us in proportion to the danger to which our patient has been exposed. But if she dies there are two, at least, who must regret that it was performed,—the patient and the doctor; and sometimes there are the husband and the little children to be thought about. But how much easier to take the patient into the hospital and in a few days perform hysterectomy, which we can do in a quarter of an hour sometimes. It is, as the French say, '*un mauvais quart d'heure*,' but it is soon over and the patient's fate is sealed for weal or woe when we have put in the stitch which closes the peritoneal cavity.

"After that the house-surgeon and nurses take care of her, and an average of three minutes a day for the next twenty days is the very most she requires of us. But with the electric treatment, what with getting the patient ready, carrying out the asepsis of the vagina, and adjusting the apparatus, I have spent as much as one hundred precious hours on a single fibroid case. But the ovaries remained and many of the women are now the happy mothers of children and others are happy wives, capable of having children, though childless.

"I have lately asked several well-known men, men of the highest surgical reputation (you would be astonished if I mentioned their names), whether they had employed the electric treatment with good results, and they have assured me that they had, although they have never reported them; and when I asked them what was the principal objection to it, they replied, in confidence, that it took too much of their time. And this I admit is a serious objection to it, but not an insurmountable one. There are two ways in which it may be surmounted; one is by having an assistant whose time is less precious than our own, who has been trained to carry out the treatment with accuracy and care when we prescribe it for the disease which our more experienced touch has diagnosed. And the other is by having several rooms and a nurse to prepare the patient, including the antiseptic vaginal douche, and by devoting two afternoons a week, and having these patients come only at that time, as many as six treatments an hour might be administered.

"Never before has it been so well demonstrated, as it is to-day, that by the division and subdivision of labor the workmen become

more and more expert. It does not surprise me, therefore, that the best results of the electric treatment of fibroids are obtained by such men as Apostoli and Massey, who employ this treatment alone. They both obtain results which neither I nor any other operating gynecologist can hope for. In every large city we should encourage some one man to establish an electro-therapeutic clinic, where our poor patients, at least, might obtain the benefit of his skill in electric technique, after having obtained the benefit of our experienced diagnosis; in time, his reputation would reach the ears of the rich, and he would then have some substantial reward.

"The present *status* of electricity is suffering as did the *status* of abdominal surgery a few years ago, because it has been tried by men without sufficient experience, and has, as a consequence, been found wanting. The electric treatment of fibroids requires knowledge of the pelvic contents as well as the electrician's knowledge of the power he is wielding.

"I must trespass on your time yet a little more while I refer to two points. One, a claim which has recently been made by Apostoli for the electric treatment, which I can heartily indorse; and the other an objection which has been made to it, which I can as heartily deny.

"Apostoli has discovered that the very failures of electricity can be turned to advantage in the following manner: It has been found that in those cases where the electric treatment has been badly borne and has been followed by febrile reaction, so that the patients have been turned over to the surgeon for operation, the presence of pustules and pelvic peritonitis has been discovered. Apostoli has pointed out that electricity may be employed as a diagnostic agent for the purpose of detecting diseased appendages.

"A remarkable instance of this came under my notice over a year ago. A young woman who had been employed in a restaurant in a New England town gradually lost her health, and had pain and hemorrhage. She suffered agony with her periods, which came too often and lasted long; so that her face was blanched and haggard. There was no difficulty about the diagnosis, as the tumor was large, round, symmetrical, in the median line extending up to the umbilicus, and could be easily seen and felt, bulging up the abdominal wall. Several physicians in the United States, her family physician in Montreal, as well as myself, all agreed that it was a fibroid. One of them had tried electricity several times, but always with bad results, and

so did I. As she was laid up in bed for several days each time, I concluded that the appendages were diseased, and after three applications I decided to stop and to perform celiotomy. On opening the abdomen the tumor was at once seen surrounded by adherent intestines, but it still appeared a symmetrically pear-shaped fibroid. I could not, however, find the ovaries and tubes, and, while digging around for them, I made a line of cleavage which, being followed up, I was able to dissect out a portion of the tumor; it proved to be a sausage-shaped pus-tube; this was delivered intact, tied, and cut off. Then followed a large cystic ovary; then the other tube, which broke and inundated the field with pus; and then the other ovary, by which time the supposed fibroid was gone and only a moderate-sized uterus remained. The pelvis was carefully washed out and drained; the patient made a rapid recovery and is now at work and enjoying perfect health. So that, in this case, Apostoli's *dictum*, that when the application of his method causes febrile reaction the tubes are badly diseased, was fully borne out.

"Now, the objection to electricity which has so often been made to it, especially by one of my most esteemed friends in Philadelphia, that it causes adhesions, is not true. I maintain that one has no right to bring that charge (1) if fibroids which have never been treated by electricity do have adhesions, and (2) if fibroids which have been treated by electricity can be proved not to have become adherent.

"Now, I am in a position to prove both of these facts. When in Baltimore I saw the abdomen opened for fibroid, but it was so adherent to everything, intestine and abdominal walls, that the operator, one of the ablest in the world, did not consider it possible even to get the ovaries out, and the abdomen was sewed up. Now, this case, the most covered with adhesions I have ever seen, you will say, had received many applications of electricity, and so I thought, judging from these statements, must have been the case. But careful inquiry elicited the fact that she had never received a single application of electricity. But that is only negative evidence. Let us see about some positive evidence.

"Three or four years ago I treated a lady, head-mistress of a large public school a thousand miles away, for hemorrhage and pain, by means of intra-uterine positive galvanism. She had received one year's leave of absence from her duties and the commissioners had advanced her one year's salary in order to regain her health, she

being utterly incapacitated for work. You may imagine that she was peculiarly anxious to get well, and therefore submitted to a very rigorous application of the treatment three times a week with great fortitude, as high as 200 milliampères being frequently given at a time. And this was not for one or a dozen applications, but for fifty times. By this time the bleeding and pain were nearly, if not entirely arrested, and I advised her to complete the cure by a few months' rest at her old home down by the sea in New Brunswick. This she did and came back to me in July with rosy cheeks and sparkling eyes. She and I would have been perfectly satisfied with the result, and I should have reported her among my cures, had it not been for one thing, and that was that she asked me the question: 'Can you promise me that the awful hemorrhages will not return after I have gone to my far-away home in the West?' This I could not answer her affirmatively.

"Her next question was: 'Is there any other treatment by which you can guarantee that result?' My reply was 'Yes, one only, and that is hysterectomy.' Although the operation was not required by her then present condition, yet, owing to her financial situation, which would preclude her ever coming to Montreal again, at her urgent request I removed her uterus.

"Now, if the charges against electricity have a vestige of truth in them, I must have found the tumor covered with adhesions; in fact, the tumor and appendages must have been one agglutinated mass requiring some hours of patient toil to detach them, and for this I was prepared. But what was my astonishment, on opening the abdomen and screwing a cork-screw into the tumor to be able to lift it out smooth and shining as the top of a bald man's head; the transfixing of it with pins and circling it with the *serre-neud* was the work of a few moments and in a minute more the tumor was off. She ran her 5 or 10 per cent. of risk of death safely, and made a splendid recovery and was at the head of her school once more on September 1st.

"One such case carries more weight than a thousand assertions that electricity causes adhesions.

"But I can duplicate it. A young lady who is now a trusted nurse in a New York hospital came to me, the first year I used this treatment, for hemorrhage and pressure symptoms caused by a large fibroid. She improved so much that I decided that she ought to go

home by the time she had received fifty applications. But after the last application she began to flow before the time, and I asked her to wait until it stopped. It lasted seventeen days, a steady little stream of dark-red blood. I became momentarily discouraged and advised operation, which was accepted, but I handed her over to a more experienced operator than I was, at that time. I assisted at the operation and the tumor came out without the slightest difficulty, and was removed in the same way as the case mentioned above. I examined it most carefully and the only trace of an adhesion to be found was a spot about the size of a silver 5-cent piece, where the tumor had rubbed upon the brim of the pelvis on the right side and where she often complained of pain before coming to me. But there was not a sign of adhesion in the track of the electric current nor anywhere else except this one spot. The hemorrhage was due to a tiny opening in a sinus by the end of the electrode.

"I dislike electricity, personally, because it takes up my precious time, but I want it to get fair play and not be blamed for sins that are not its own.

"There is one charge, however, which was frequently brought against the electric treatment of fibroids or rather against a method of applying it, in the past, and which was well deserved, but no longer applicable, because no longer employed. I refer to the method of galvanic puncture.

"The greatest claim for the electric treatment of fibroids that can be made is that it has no mortality and that it is absolutely safe. If it is not safer than any other treatment, or, in fact, unless it is absolutely free from danger, there remains only one advantage in its favor,—namely, the saving of the ovaries. But galvanic puncture, no matter how performed, whether by the vagina or through the abdominal wall, must ever be a procedure fraught with danger, and is to-day practically abandoned. If anyone still uses it, in the cause of electric treatment of fibroids, I beseech him to use it no more. The positive pole of the galvanic current gently introduced into the uterus will accomplish our object by unseen, but no less certain, means. It dries up the juicy, bleeding, mucous membrane, and by its tonic action upon the muscular tissue through which must pass the vessels carrying nourishment to the tumor, its blood-supply is cut off just as surely as though we tied the ovarian arteries which supply the body of the uterus. The action of the electric current as applied to fibroids

is threefold. The first is not mysterious; it is but the arrest of circulation in dilated capillaries by an electro-chemic cautery. The second is no more difficult to understand than the action of ergot or strychnine; it not only tones up the vasomotor system, making the calibre of the arteries less, but it calls into play the special and remarkable power which the uterus possesses of controlling its own circulation when it has the strength to contract. The third effect of the current, its electrolytic action, is, I admit, as mysterious as it has ever been, but not more so than the invariable absorption of syphilitic gummatous deposits following the administration of iodide of potassium. Whether what we call electrolysis means the actual breaking up of an organic tissue into inorganic atoms, or whether it means, as seems more likely to me, that the growth deprived of its blood-supply undergoes fatty degeneration and is partly eaten up by phagocytosis, stimulated to greater activity by the trophic nerves, no one with a large experience with this subtle fluid can deny that a uterus infiltrated with and enlarged by the deposit of fibrous tissue, whether localized in the form of fibroids or diffused, as in areolar hyperplasia, so that the sound will enter four or five inches, will invariably diminish in depth by means of electric treatment.

"Then again, what is the enormously enlarged uterus after delivery but a bleeding myoma? Does it not stop bleeding when the arteries which supply it with blood are squeezed by its contracting walls? Does it not rapidly get smaller when, for the want of blood and exercise, the immense mass of tissue silently undergoes fatty degeneration and returns to the blood, from whence it came?

"Wonderful and almost incredible as the total disappearance of a fibroid or myoma may seem to some, it is no more mysterious than this wonderful process of nature which we call involution. Have those who doubt, and, even worse, deny the power of electricity to work a change in fibroids, never reduced the size and weight of a uterus which nature had failed to involute? Has Emmett never reduced its size by repairing a lacerated cervix? Have Churchill and Athill and ten thousand others with honored names never reduced the quantity of tissue in the uterus by the application of iodine? Have not a hundred thousand others ever reduced the weight of the blood and muscle and areolar tissue in the heavy uterus by means of glycerin and hot water and other therapeutic measures?

"Then why, in the name of reason and justice, will you deny that

an agent which we can see blanching tissues before our eyes, and making muscles of every kind contract, why will you deny, I say, that it can diminish the blood-supply to, and favor the fatty degeneration and absorption of, the fibrous or myomatous uterus?

"The electric treatment of fibroids, reduced to the above simple equation and stripped of all the extravagant claims which were at first made for it, stands to-day upon a foundation so strong and true that it will find an honorable place in the treatment of fibroids as long as women shall dread to die by the surgeon's knife, which I believe will be as long as the world shall last."

These eloquently expressed convictions of Dr. Lapthorn Smith are so important that I deem it but proper that his paper should be quoted in its entirety, yet I must take exception to the adverse opinion expressed concerning electro-puncture. That this method should be retained in the hands of experts only I will fully grant, but there has been nothing in my personal experience to condemn the method. To show that my position is borne out by the experience of others I will quote a recent paper from the Transactions of the Edinburgh Obstetrical Society for 1896-1897 by F. W. N. Haultain, M.D., F.R.C.P.Ed., Lecturer on Midwifery and Gynecology in the School of Medicine of Edinburgh. The paper was read on March 10, 1897.

"More than two years ago I gave an account of my experience in the electrical treatment of uterine fibromyomata, with, perhaps, an enthusiasm as to the benefits to be derived from its employment, which, from the somewhat limited number of cases cited, might be questionable. Since that time to this I have continued to follow this method of treatment in similar cases, with results so encouraging that any enthusiasm then shown in its favor is, if possible, more pronounced.

"It is not my intention to dilate further on the general hemostatic and curative properties of the treatment, beyond mentioning that in these respects it has since amply fulfilled the sanguine expectations I then formed of its value; but it is my desire to place before you a record of three cases, treated by electro-negative puncture, which are, perhaps, of more than usual interest. They represent, I may add, my entire experience in this method of electrical treatment.

"Case 1. Mrs. H., aged 36, had suffered for many years from a large uterine fibroid, which had, from the attendant hemorrhage, so

reduced her health that Dr. Croom decided to remove her appendages. This he accordingly did on the 29th of October, 1893.

"The operation, unfortunately, had no beneficial effect, either in arresting the hemorrhage or the growth of the tumor, and her condition went from bad to worse. From the extension downward of the tumor into the pelvis, pressure symptoms of a most exaggerated degree were developed. These consisted in complete urinary incontinence after previous retention, agonizing pains in the back, cramps of the lower extremities, and albuminuria,—probably the result of pressure on the ureters. At the same time profuse uterine hemorrhage rendered her exsanguine to a marked degree. Except under morphine she had, for months, never been free from pain, and, quoting from her own words, she 'frequently prayed for death to relieve her sufferings.' During this period injections of ergotine and other forms of medicinal treatment had been assiduously carried out.

"By Dr. Croom's request I was consulted by her on the 7th of December, 1894, as, before undergoing hysterectomy, which had been recommended, she wished to know if electricity could be of any benefit. Though apparently hopeless, I determined to at least give her a trial of the electric treatment. In this determination I was supported by Dr. Milne Murray, who saw the patient, and of whose opinion I gladly availed myself. The local condition, on examination, showed the true pelvis to be filled with a tumor, which encroached on the vagina to such an extent that it was impossible to reach the cervix, which was high above the symphysis pubis. The upper border of the growth reached to three fingers' breadth above the umbilicus (Fig. 54).

"On the 14th of December I commenced the electrical treatment, and adopted electro-negative puncture through the posterior vaginal wall as the only method available. At this sitting I was enabled to pass a current of 150 milliampères without great discomfort. The treatment was repeated on the 21st; and on the 23d the patient informed me that since the last application she had been entirely free from pain, an experience she had not had for months, and, further, that she could retain her urine while in the recumbent position. The applications were continued at weekly intervals, and after the seventh application, on the 26th of January, she had absolute control over her bladder in any position. Applications were continued twice weekly until twenty had been given, and as the

hemorrhage had now considerably abated, and the pain absolutely ceased, treatment was discontinued on the 19th of March. Unfortunately, late in July, feeling particularly well, she resumed her corsets and went for a long walk, with the result that the old pressure pains and urinary symptoms returned, associated with severe vomiting and an increase in the albuminuria. The electrical treatment was again continued with the same satisfactory result as regards symptoms, and after the tenth application I was astonished to find that the tumor had entirely passed into the abdominal cavity, and the

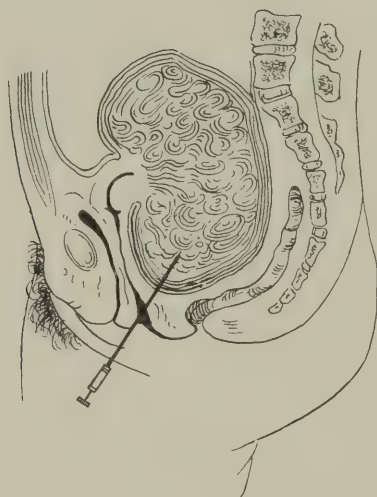


Fig. 54.—Outline of tumor in Case 1 of Dr. Haultain's before treatment.
(Haultain.)

cervix could be reached with ease. Intra-uterine positive electricity was now commenced, and a further ten applications given, treatment being altogether suspended on the 10th of October, 1895. Since that time she has been in absolute health; menstruating regularly, for about five days; and, on examination, the tumor can now be felt freely movable in the abdomen, and springing from the fundus uteri, its upper border reaching about two fingers' breadth above the umbilicus (Fig. 55). It would thus appear that the tumor was essentially of the subperitoneal type, and had become accidentally

incarcerated in the pelvis, where it had continued to grow, but, after having become diminished in bulk, it had returned to the abdominal cavity.

"Case 2. Miss S., aged 38, consulted me in February, 1893, on account of a large fibroid tumor which, for a week previously, had caused complete retention of urine, and necessitated the regular use of the catheter. For some weeks before this time she had suffered from occasional transient attacks of urinary retention, which occurred about her menstrual period. She had already consulted an eminent specialist, who stated that nothing short of complete removal of the

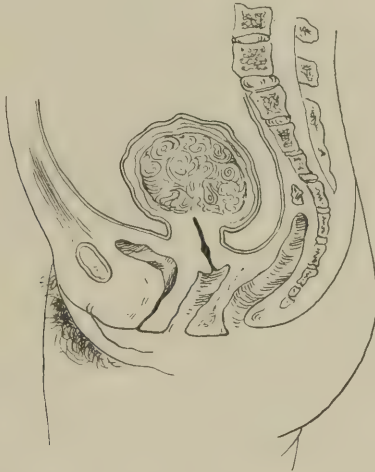


Fig. 55.—Case 1 after treatment. (Haultain.)

growth would benefit her; but, having heard from a friend about the electrical treatment of tumors, she decided to try if, by this means, anything could be done for her, before, as she graphically put it, she allowed herself to be 'cut up.'

"Beyond the urinary retention and its associated discomfort, she did not complain of any other well-marked pressure symptoms. She was stout and plethoric in appearance, and, further than suffering from a dull and almost constant headache, and a feeling of weight and fullness from the presence of the tumor, she felt strong and well. She menstruated regularly, but scantily, for about two days. On

examination, a large, solid swelling could be felt in the abdomen, reaching to two fingers' breadth above the umbilicus, continuous with a large solid mass within the pelvis, which so obstructed the vaginal examination that the cervix could not be reached (see diagram, Fig. 56). Energetic attempts to push the pelvic portion of the tumor above the pelvic brim proved absolutely futile, though made with the patient anesthetized and placed in the prone and genu-pectoral positions.

"Treatment by electro-negative puncture was commenced on the

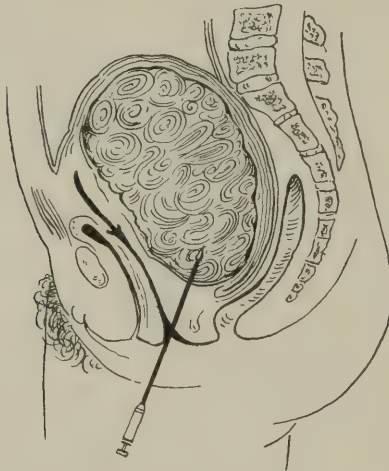


Fig. 56.—Outline of tumor in Case 2 of Dr. Haultain's before treatment.
(Haultain.)

24th of March, a strength of current of 180 milliampères being used, with the astonishing result that spontaneous micturition could be accomplished the same afternoon, and from that day to this a catheter has never been again required. The first menstrual period was extremely profuse, and lasted ten days. Subsequently, fifteen electro-punctures were made within the next ten weeks, and by the middle of May the growth had so materially lessened in size that I could with difficulty reach the cervix, and was able to introduce the electrode within the uterus. The cavity measured four and three-fourths inches. I then continued the treatment by giving a further fifteen

applications with one electrode in this situation. I, however, maintained the intra-uterine pole negative, as, from the increased menstrual periods her headaches had ceased, and I feared that the positive pole might here cause a diminution in the amount, which would be injurious.

"After the completion of the treatment the patient returned to her home in London, and I did not see her again till six weeks ago. On examination then I found the tumor still pelvic, situated on the posterior uterine wall, and about the size of a small cocoa-nut, the uterus and the tumor being freely movable together. The cervix



Fig. 57.—Case 2 after treatment. (Haultain.)

was easily reached, and the sound passed into the uterine cavity about three and a half inches: one and one-fourth inches less than when first measured (Fig. 57).

"The patient described herself as being in perfect health, and her menstruation perfectly regular, but much increased in amount. The tumor in this instance was evidently intraligamentary, as, though free from incarceration, it still retained its position within the pelvis.

"Case 3. Mrs. B., aged 46, was recommended to me by Dr. MacDonald Robertson in May last. She suffered from complete urinary retention, which had continued for three days. She had had pre-

vious transient attacks of similar nature. Menstruation regular and normal.

"On examination, a large tumor was found impacted in the pelvic brim, tilting the uterus high above the symphysis pubis. Attempts at reposition into the abdomen were futile. Electro-negative puncture was adopted, with the effect that the same afternoon she was able, with difficulty, spontaneously to void urine. Retention, however, recurred the following day, and persisted till the next application of the battery, when again the urine could be temporarily voided voluntarily. After the third application retention did not recur; after this, two applications were made, but the patient, being extremely nervous, refused further treatment. Since that time I have not again seen her, but hear from Dr. Robertson that he has not again been troubled to pass the catheter, and she says she feels quite well.

"On carefully reviewing the salient features of the result of the electrical treatment of the cases I have just described, the outstanding benefit derived in one and all is the rapid removal of the pressure symptoms. This, in the last two, was so immediate in its occurrence as to be difficult to credit; while in the first case, though somewhat slower in its development, it was equally striking. That this result is due to actual shrinkage in the size of the tumor there can be no reasonable doubt. Though inappreciable at first to the examining fingers, the subsequent course of Cases 1 and 2, as well as the want of other reasonable explanation, fully justifies this assumption.

"In Cases 2 and 3 symptoms of pressure had only been experienced for a few days, and therefore any great diminution in the size of the tumor was probably unnecessary to relieve the urgent conditions present, and can be accounted for by contraction of the capsule. In Case 1, on the other hand, severe pressure symptoms had been present for months, and were becoming aggravated from the continued growth of the tumor, and thus a considerable diminution in the size of the growth was necessary before they could be removed. That this shrinkage in the size of the tumor was permanent, and not merely a temporary benefit of the treatment (as is averred by many to be the only value of electrical treatment), there is no gainsaying. In Cases 1 and 2 no treatment has been adopted for more than eighteen months, yet, not only have the symptoms of pressure entirely subsided, but marked diminution in the size of the tumor is palpable. The sudden recurrence of pressure symptoms in Case

1 is easily to be accounted for by the corsets pushing the tumor deeper into the pelvis.

"Perhaps the outstanding feature in the effect of the electrical treatment in Case 1 is its success after the removal of the uterine appendages had failed. It would appear, from the writings of some eminent gynecic surgeons, that many cases previously treated by electricity subsequently find their way to them to be cured. Fortunately, such a necessity has in my experience been quite the exception. In fact, I cannot recall a single instance in my knowledge. On the other hand, it is but rarely that the electrician seems to have had as yet the opportunity of stepping in where they have failed. The case I have cited is, as far as I am aware, the only one published in which electricity had been adopted after surgery has failed, with the exception of a failure of Thornton's,¹ in which he sarcastically attributes his want of success to the patient's falling into the hands of the electricians. How the electricians fared he does not venture to state.

"In Case 2 a somewhat striking result was the increase of the menstrual flow, attended by an entire disappearance of the continuous headache from which the patient complained. This might be deemed probably of the nature of an accidental coincidence, were it not that I have observed the same results in other patients. It would appear that some exceptional cases of fibromata, even though associated with an enlarged uterine cavity, instead of increasing the menstrual flow, are actually associated with an abnormal diminution in its amount, which results in the attendant discomforts of plethora, as commonly met with at the menopause. How the electrical treatment effects an increase in the flow it is difficult to conjecture; perhaps it may be by stimulating ovarian activity; but the fact remains that I have several times met with this curious phenomenon, which has been attended by most beneficial constitutional results. Doubtless ignorance of the mode of action is unsatisfactory; and it is perhaps this want of knowledge which has influenced many in giving electricity so wide a birth, and not a few to condemn it wholesale. But satisfactory results are all-important, and, so far as I personally am concerned, suffice to stimulate me to work contentedly in darkness, as probably by this means alone will any rays of light be attained.

¹ Playfair and Allbutt, "System of Gynecology," page 629.

"A further point of very considerable practical bearing is that, in Case 1, after thirty puncture applications, the tumor rose out of the pelvis into the abdominal cavity. It thus shows that if judicious puncture methods are employed there need be no fixing of the growth by dense adhesions to surrounding structures; and thus the argument used by certain writers, that electrical treatment seriously increases the difficulties of future operation by causing dense adhesions, must, so far as this case proves, be absolutely groundless. Certainly where the old, crude methods of puncture were employed such a result was almost a necessity; but, with the insertion of the exposed portion of the electrode well within the tumor, as now employed, this complication is efficiently avoided.¹

"The practical results obtained from the treatment of the above cases by electro-puncture, I think, thoroughly justify its adoption. Doubtless but three cases are too few from which to form definite conclusions; but cases necessitating the employment of puncture methods are fortunately rare, and where the intra-uterine method can be undertaken it should always be adopted, the results being equally satisfactory, less irksome to carry out, and associated with probably less risk to the patient. As I have already stated, the cases cited represent my entire personal experience in the electro-puncture methods, or, in other words, were all that I have seen (among over eighty cases in which I have adopted electrical treatment) in which I have been unable to insert the electrode into the uterine cavity.

"If such beneficial effects are to be got from a conservative method in the treatment of fibromyomata, it is, indeed, surprising how little its adoption is advocated, not to say how heartily it is abused.

"May be this is due to medical 'electricity' forming the trademark of so many advertising quacks, which thus shock the modest conservatism of the high-toned, professional mind; may be, on the other hand, it is the prolonged irksome nature of the treatment which prevents its adoption by the busy gynecologist; or, perhaps, its methods are too simple and commonplace to induce the laparotomist to leave the beaten track of the linea alba, on which he is ever trying

¹ Dr. Haultain explains, in an unquoted portion of the paper, that he employs buried puncture, the details being similar to those given in the present work and probably first suggested by me in the first edition of "Electricity in the Diseases of Women," in 1889.

to establish world-records of statistical successes. But, whatever the cause may be, I think there can be little doubt, from a conservative point of view, that the electrical treatment of fibroids has not as yet had bestowed upon it the consideration which its results warrant.

"It has its failures; but what methods have none? It has, however, no mortality (this I state from personal experience and observation), and here, undoubtedly, rests the main argument in favor of its adoption before other heroic measures are attempted.

"Removal of the appendages has, in the hands of the average operator, a mortality of 8 per cent., and in a further 10 per cent. fails in any way to benefit the patient. According to Croom, 20 per cent. of women continue to menstruate after this operation. Further, in a considerable proportion of cases in which this operation has been begun it is unable to be completed.

"Hysterectomy, in the hands of the most able and finished operators, has a mortality of 10 per cent., and an average mortality of quite three times that amount.

"Surely, then, if electricity as a conservative measure has any beneficial results whatever (and I can personally vouch for a permanent removal of symptoms for over two years of over 70 per cent. of cases), surely it cannot be altogether rejected and refused a legitimate trial.

"The two main conclusions which may be arrived at from the cases quoted seem to me to be:—

"1. That electricity has a decided curative action in some cases of fibromyomata, when nothing else short of severe surgical measures can be recommended.

"2. That from the absence of mortality in its employment, and also in that it in no way increases the danger of subsequent operation, electricity should, in a large proportion of cases of fibromyomata, be employed before recourse be had to radical surgical interference.

"I do not wish to be sentimental, but I appeal to human inclinations. In a case of one who is near and dear, who suffers from chronic invalidism as the result of a uterine fibromyoma, I ask whether many of us would subject her to an 8-per-cent. risk of life, with a further 15-per-cent. risk of failure by removal of the ovaries, or the terrible mutilation of hysterectomy, before at least trying all conservative means at our disposal. Personally, I unhesitatingly say

I would decline, and thus would give electricity, as the most efficient conservative treatment, an honest trial. No harm is done, no valuable time is lost, for in the majority of instances fibromyomata do not call for immediate interference. If it do fail—which in my experience is the exception—we can then proceed with an easy conscience to other more radical and drastic measures. Why ovaries and uteri should be treated with less courtesy than other important organs (not to mention the teeth, which have bestowed on them in many instances infinitely more care and trouble to conserve them) is an enigma difficult to explain. Perhaps woman is herself to blame, the tendency of the age being to minimize the importance of these reproductive functions, of which her matronly ancestors were so proud.

“If such be so, it is little credit to the medical profession to foster the idea by condemning these organs, for but minor offenses, to capital punishment without any option.”

Dr. Lackie, in the discussion of Dr. Haultain's paper, said that he had had an opportunity of watching one of the cases which Dr. Haultain had recorded. The patient at one time seemed to him to be dying from pressure symptoms and exhaustion, but the effect of the electrical treatment which Dr. Haultain carried out was such that now she seemed perfectly well. Hysterectomy was out of the question, as the patient almost certainly could not have borne the shock of the operation; and as it was impossible to reach the interior of the uterus on account of its displacement, he did not know any other means that would have reduced the tumor and so saved the life of the patient. Dr. Lackie had recently observed in another case the effect of electricity in causing contraction of the uterus. Under this treatment a bleeding sessile fibroid had rapidly become polypoidal, and been easily removed, with great relief of symptoms.

CHAPTER XI.

DISPLACEMENTS AND NON-TRAUMATIC RELAXATIONS OF THE PELVIC VISCERA.

THE subject of displacements of the uterus occupies a large share of the attention of practical gynecologists, partly on account of their inherent importance, and partly because the sufferings due to other conditions have been too frequently attributed to the displacement, under the ultramechanical development of the older gynecology, which regarded each elaborately classified bend or tilt as a pathologic entity, to be corrected by a specially shaped pessary. Fortunately for our reputation for common sense, these several bends and tilts, with the exception of retroflexion and prolapse, may now be regarded as of no more practical importance, *per se*, than the shape of the patient's nose. Unless the bend or tilt is accompanied by a catarrhal or hyperplastic condition or by fixation of the uterus or other abnormality, it possesses absolutely no significance. The uterus being normally a most mobile organ, it is readily seen that the chief enemies of its static equilibrium are fixation, on the one hand, and either torn or atrophied supports or undue bulk on the other, and that our therapeutic efforts should be directed to a removal of these more important accompaniments.

It is most important, also, to ascertain the chronologic sequence of the congestion or hyperplasia and the displacement in cases of mobile prolapse and retroversion not due to laceration, and here is where a singular lapsus occurs in the current views of many gynecologists, who, while fully convinced of the microbic and neural causation of other inflammations, still adhere to the older theory of a mechanical cause for this one. My experience with two classes of young women has convinced me that *the congestion and enlargement of the uterus is the initial lesion in all cases except those due to laceration of the pelvic floor at childbirth*, the displacement being secondary and sequential: the proof of this is the great rarity of prolapse and retroversion in *nulliparous* peasant women who carry heavy

weights, and the invariable association of endometritis with the very earliest stage of (and doubtless preceding) the prolapse or retroversion of young women of the better classes. This sequence of events applies equally well to puerperal subinvolutions, which are a most fruitful source of displacements and relaxed ligaments. In these cases all admit that the causal condition is the failure of the physiologic changes that normally reduce bulk and replace effete muscular tissues. The hypertrophy necessarily antedates the displacement.

It is not to be denied, of course, that the elevation of an enlarged and catarrhal or subinvolved uterus by a pessary may, at times, relieve the intrinsic condition of the organ, though it usually fails to do so; but this occasional result is no reason to assume that the displacement or tilt was primary. Unless the advocates of the mechanical theory are prepared to affirm that the bend, tilt, or descent is to act the part of the microbe in this particular inflammation, they should admit that its etiology must be the usual one, and that the uterus has become tilted or prolapsed because it had become heavier as a result of the catarrhal attack. This reasoning does not exclude the mechanical contributing causes of retroversion and prolapse in non-lacerated cases due to the pressure of a tight corset, lifting weights, or a sudden jar or fall, but explains how these mechanical causes, acting upon an already heavy uterus, are enabled to effect a dislocation of an organ naturally capable of most extensive movements without harm.

The bearing of this question of the chronologic sequence of the congestion and displacement on the practical details of treatment is evident. An actual cure demands that particular attention be paid to the hyperplasia primarily, or to its cause in endometritis, metritis, or other inflammatory conditions that may still exist, and, if the remedy employed be the galvanic current, a concurrent treatment of the relaxed supports is also gained. A therapeutics aimed merely at the effects of these trophic disturbances—the sagging—is unscientific and at times harmful. What can be worse in its effect upon already weakened muscular structures than placing them in splints by the employment of a pessary? Nature, surely, never designed that a skeleton should exist within the vagina, and if the purpose of the physician in placing one there be not to improve upon nature's permanent arrangements, but merely to use this means to strengthen the muscles, it should be recalled that the whole teaching of the modern treatment of muscular

insufficiencies tends to magnify the value of gymnastics and to discredit support and fixation. Many cases of moderate descent of a too-heavy uterus have been rendered permanently incurable by the persistent use of these contrivances, causing atrophy of the vaginal muscular layers and round ligaments. Their only proper indication is in the incurably dilated vaginas of middle-aged or elderly women, where a properly fitting support gives immense comfort, and should be worn, under frequent observation, until senile involution contracts the vagina and renders the uterus smaller.

ELECTRIC TREATMENT.

The Author's Method.—The pathologic basis for the use of electricity in displacements and relaxation of the pelvic structures without fixation is of a twofold nature, dependent, on the one hand, on its power to cure inflammatory conditions of the uterus which have produced added bulk or congestion, and, on the other, due to its stimulation of the muscular structures of the uterus itself and its supports. Viewed in either light, its great adaptability as a curative agent is evident, for it associates the two essentials of diminishing the bulk and increasing the power of maintaining it. Clinical results fully bear out these theoretic conclusions, the only exceptions being cases where the muscular structures have entirely disappeared by fatty degeneration.

The details of treatment are largely dependent on whether the organ is freely movable or is fixed in its displaced position by the adhesions of an old pelvic peritonitis or by diseased appendages. In the latter case the applications must be restricted to the vaginal method until a considerable mobility has been gained, when, if it is deemed wise to do so, the intra-uterine treatment may be begun. Here the principal source of suffering is usually due to the inflammatory conditions external to the uterus, which, in addition to being of prime importance of themselves, usually constitute a bar to intra-uterine treatment until greatly bettered. Both galvanic currents of 50 milliampères or more and secondary faradic currents should be used at each *séance*, with a cotton-covered vaginal electrode and abdominal pad. (For details of method see page 56.)

If the uterus, on the other hand, is movable and evidently larger than it should be in the particular physiologic condition of the patient,

and especially if there be a purulent leucorrhea, positive intra-uterine galvanic applications may be begun at once with an appropriate electrode, followed by the contracting primary faradic current. It is often best to intersperse several vaginal applications between the intra-uterine, if the patient is in a position to receive daily or tri-weekly treatment.

Nothing has been said, so far, of bipolar faradic applications in displacements. Where the faradic current alone is to be used, I usually prefer the bipolar method, either within the uterus or vagina, now that I have been able to thoroughly asepticize the instruments, but as I rarely employ the faradic current alone in these cases I find it best to use the same monopolar electrode and one insertion for both currents, turning on the faradic current after the galvanic has been turned off.

The intra-uterine applications suitable to the curative treatment of the conditions underlying retroflexion or prolapse of non-adherent uteri are exactly similar to those advised in chronic metritis (page 95), and exactly similar contra-indications govern its employment. It is usually wise to correct the displacement, however, immediately before each application. This is best done, in early and painful cases, by placing the patient in the knee-chest position and replacing the organ by manipulation with the fingers, assisted by gravity and by pressing on the fundus through the posterior vault with a pledget of cotton in a pair of dressing-forceps. In less tender cases of retroflexion this is not necessary, the repositing being easily and painlessly accomplished by inserting the sound-shaped electrode into the retroflexed cavity with the patient in the dorsal position. Pushing the handle toward the pubis, the tip is now rotated gently forward before turning the current on, the action of the sound being assisted by pressure of the tip of the finger in the posterior vault, when the fundus will usually glide easily into place if not pushed too far back against the promontory of the sacrum. The current is now turned on, as in the treatment of chronic metritis, the contracting faradic current usually following immediately after the positive galvanic application from the same instrument.

There is a distinct contraction, usually noticeable in these cases, immediately after the application, and it is extremely rare that it is necessary or wise, in the author's opinion, to follow this application up with any kind of continued support, though some operators use

a wool tampon with glycerole of tannin or boroglyceride between treatments. As this distends the vagina, it is apt to measurably interfere with the strengthening of its muscular coats: a distinct object in the electric treatment of these conditions. Without its use the extent of reposition required at each succeeding application will gradually become lessened until that more or less permanent residuum of either retroflexion or prolapse is attained which persists after practical, symptomatic cure, even when all evidences of hyperplasia and inflammation have disappeared.

Such are the most important details in the electric treatment of prolapse, retroversion, retroflexion, and the occasional cases of pathologic anteversion, accompanied, as they usually are in all stages, by engorgement, hypertrophy, or periuterine inflammatory consequences, and this form of treatment is almost always capable of removing pain, weight, discharge, constipation, or other evidence of a morbid condition. It is by no means always possible to entirely correct the backward bend of the uterus or the downward sagging in prolapse, the former being due to a local atrophy of the longitudinal muscular fibres of the uterus and the latter to profound changes in the muscular and fascial supports of the abdominal pressure, but enough improvement may be gained from the cure of the intrinsic uterine inflammatory conditions to take away all unpleasant symptoms and leave the patient unconscious of any departure from the normal position and shape of the organ. The following cases are excellent illustrations of the possibilities of benefit from the measures recommended in prolapse, the cases illustrating other displacements being included among the cases of chronic metritis.

A young lady of 26 years, sister of a physician, who had suffered from menorrhagia and probably an endometritis since puberty, and had been dilated two years before seeing me with but slight relief from the intense pain at the periods, presented the typical symptoms of almost complete prolapse at time of consulting me, the uterus just presenting at the vulvar outlet. The body of the organ was slightly enlarged and all supports relaxed, the vagina being distended and thin-walled, doubtless from the fact that she had worn a Smith-Hodge pessary for eighteen months. The pain in back, bearing-down sensation, and weight were so great as to incapacitate her for the most ordinary activities. Of late, she had been sleepless and nervously exhausted. The pessary was at once removed and daily vaginal appli-

cations made with both currents for three weeks, with two intra-uterine applications, the patient being told that she would feel worse for a time. Later, intra-uterine applications were employed once a week, averaging 35 milliampères. At the end of two months the uterus was sensibly smaller, remained higher, and gave only occasional symptoms of discomfort. The applications were now made once a month for three months, resulting in complete symptomatic cure. An examination at the end of a year showed the uterus in only mod-



Fig. 58.—Sectional view of a case of hypertrophy and prolapse of the infravaginal cervix.

erate prolapse, the vaginal supports firmer, and the patient unconscious of any remnant of the trouble.

G. R., aged 20, applied at the clinic of the Howard Hospital on August 20, 1897, with complete prolapse of an hypertrophied uterus (Plate XX and Fig. 58). The cervix protruded about two inches beyond the vulva. On passing the sound into the cavity of the uterus it entered seven inches. Bimanual examination showed that the fundus was well up in the superior strait. The condition had lasted two months.

PLATE XIX



Traumatic Relaxation of the Pelvic Outlet with Cystocele and Rectocele

PLATE XX.



Hypertrophy and Prolapse of the Infravaginal Cervix in a young negress

The protruding cervix was pushed within the vulva and an intra-uterine application of mercurio-cupric cataphoresis made with 80 milliamperes, followed by primary faradic current. The vagina was then packed with absorbent wool. On September 3d the uterus was still within the vulva, and the treatment was repeated with a current of 40 milliamperes at this time and on four subsequent occasions, without packing the vagina. Two months later the uterus was normal in size and position.

The results of intra-uterine treatment for retroversion and retroflexion are about equal in effect to those gained in prolapse, it usually being easier to secure a symptomatic cure than an anatomic one, particularly in retroflexion, though the anatomic improvement is very great.

Tripier's Method.—The distinctive feature of Tripier's method of treating displacements¹ is the local application of the faradic current to the atrophied fibrils of muscular tissue. This involves the direct, localized action of this current on the convex aspect of retroflexion and antelexion. In retroflexion the current is localized in the anterior wall of the uterus, therefore, and in antelexion it is localized in the posterior wall. His directions for the treatment of antelexion are as follow:—

"The first thing to be done is to lubricate the rectal probe (Fig. 59), although it is the last one to be used, as later the operator would have no disengaged hand to do so. Then a towel should be placed within reach.

"The uterine exciter (Fig. 60), having been dried by the left hand, is inserted into the uterus, using for this purpose the left forefinger as a conductor. After this the rectal probe is inserted; this is the most delicate part of the operation; if not well done it might be very painful. The olive must pass the internal sphincter, leaning a little on its upper edge, the concavity of the instrument pointing downward; after this it should be pushed forward, below, and a little to the left. When the olive has thus reached the bottom of the concavity of the sacrum a pause should ensue, then turn the probe while elevating its pavilion so that the concavity of the curvature is turned

¹ "Engorgements and Displacements of the Uterus," by A. Tripier, "International System of Electro-Therapeutics," page G-135. Philadelphia: The F. A. Davis Co.

upward, and in this way cause the olive to face the rear wall of the uterus. It would naturally seem that, on account of the development to the left of the rectal ampulla, the rotation would be easier on that

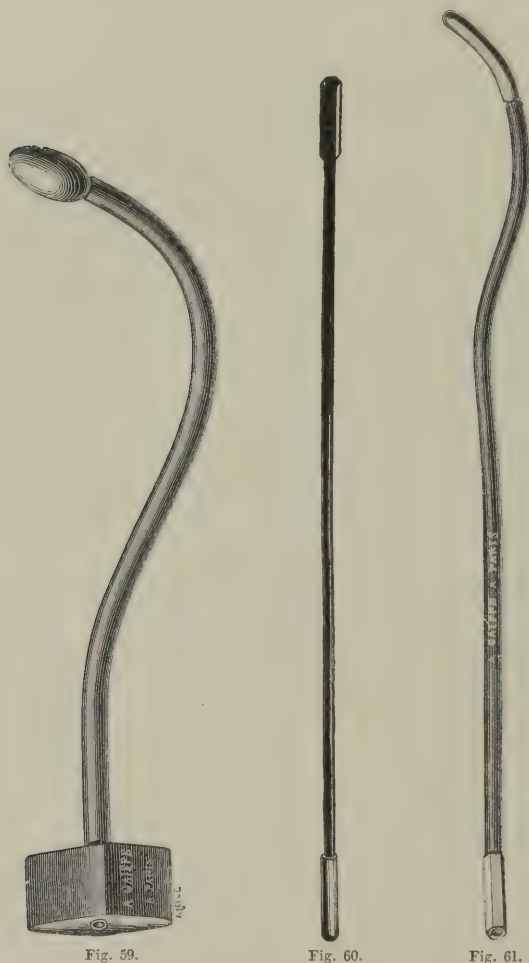


Fig. 59.

Fig. 60.

Fig. 61.

Figs. 59, 60, and 61.—Tripier's rectal, uterine, and vesical electrodes for displacements.

side, but this is not the case; I have always found it infinitely easier to the right, and I have tried it both sides. After pushing the olive from right to left in the concavity of the sacrum, it must be brought

back to the right, while turning the concavity of the probe more and more toward the right. The pavilion, being held in the hand of the rectal probe, must be slowly elevated during this rotation movement until it has been completely effected. This precaution is necessary, first, in order not to use the uterus roughly; then, that the movement of rotation may be more freely effected.

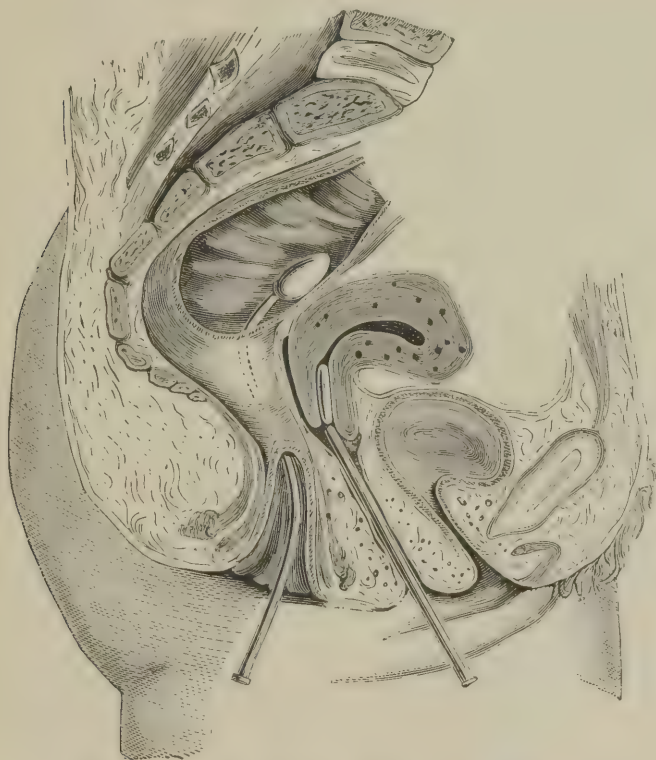


Fig. 62.—Tripier's faradic method for antelexion.

"When the curvature of the probe has been brought parallel to that of the sacrum, then only can the hand be gently lowered, pushing lightly so that the olive may come up, sliding against the wall of the uterus.

"This last motion, however, must only be accentuated when faradization has begun, in order to give it strength and assure a sufficient

contact. The rotation movement just described is not always accomplished without meeting with some resistance; this is sometimes easily overcome, but at other times it may be difficult. The operator should be able to judge according to the impression received by the hand controlling the probe. The most ordinary obstacle to this maneuver

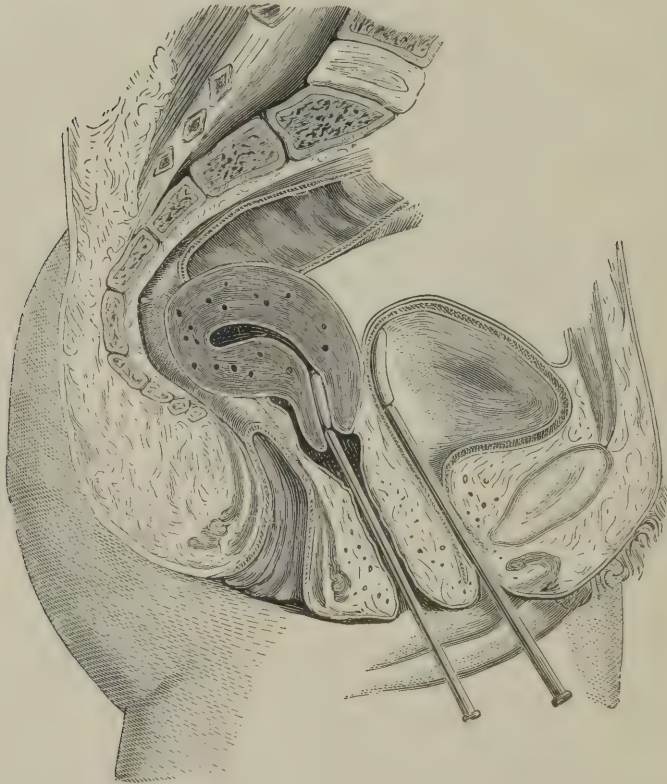


Fig. 63.—Tripier's method of faradic treatment for retroflexion.

is the presence of a fecal mass, hard or soft, and it is something that cannot be foreseen. The best way to avoid it is to give the patient an injection of oil before the application.

"The rectal exciter, once placed, should be held in position; then the conducting-cord must be attached with the right hand, which

must, at the same time, hold the uterine exciter. It is necessary to get accustomed to manage these two exciters with the same hand, the other hand being free to control the faradic battery and to govern its action. This hand directing the apparatus must, however, be able now and then to assist the other one, if any cause should present itself to modify the connection of the two probes, in accentuating the motion of the rectal probe. The fact is that a definite position cannot always be given at once to the rectal probe. I have already described one obstacle to its progress: the existence of a fecal mass in the intestine. If this should happen to be of any considerable size and a little soft it might cover the posterior wall of the uterus as with a plaster, which could only be penetrated little by little during the application. Muscular contractions form another obstacle to placing the probe. These alter the form of the cavity where the evolutions take place. They are of a flexible nature, and give way under the influence of faradization; however, the resistance they present cannot be overcome at once, and it is by interrupting the rotation during the application that this can be avoided.

"In retroversion and retroflexion the anterior wall of the uterus must be acted upon and vesico-uterine faradization employed (Fig. 63). The patient being in the dorsal position, the uterine exciter is first inserted, then the positive vesical, which is previously lubricated. After this the contacts are established and the apparatus put in action; the same hand then places the two probes in the required contact. The insertion of the vesical exciter is made like that of any ordinary probe: the pavilion (handle) must be raised at the time of operating, but only at that time, so as to lean the active tips on the anterior wall of the uterus.

"The application should not last longer than three minutes, to avoid fatiguing the muscular structures."

CHAPTER XII.

RELAXATION AND FUNCTIONAL INCAPACITY OF THE ABDOMINAL WALLS AND VISCERA.

IN the remarks on the general examination and classification of cases, on page 10, emphasis was laid on the necessity for distinguishing between pelvic affections and those that have their origin in relaxations and displacements of the abdominal viscera. These latter affections are almost peculiar to women, owing to the frequency with which their causation may be traced to the combined effects of corset-wearing, pregnancy, and sedentary habits. A few words on their clinical aspects is most necessary in a treatise on the conservative treatment of the diseases of women, and particularly in this work, owing to the unique value of a certain combination of electric currents in their alleviation.

Few women pass through one or more pregnancies without a residual weakening of the abdominal walls, which, if uncorrected, remains a menace to their intra-abdominal tone in after-years. No one can believe for a moment that this abdominal laxity and protrusion is a necessary sequence of pregnancy, and there can be no doubt that it owes its presence to the pestilential corset imposed upon occidental women by a barbarous whim of our civilization. And do not let us be self-deceived on this point. I do not refer at all to tight-lacing and its horrible results on the abdominal viscera, but to the so-called loose-fitting corset of most comfortable shape, whose harmful effect is due to two factors: 1. It supplements the natural body-wall of the abdomen by an artificial, external skeletal support never intended by nature, resulting in atrophy and weakening of the abdominal muscles: the natural support of the body-wall at this point. 2. During and after the first pregnancy this artificial skeleton, which had heretofore been a moderately equable support to all of the muscles of the abdomen, is efficient in the upper portion only, leaving about one-

half unsupported in this way, and resulting in a removal of pressure and consequent protrusion of the lower half of the abdomen. This leads directly to either partial or general enteroptosis, or displacement of the hollow viscera, and—if there is a tendency to fatty degeneration of the organs—to morbid dilatations also.

The dragging sensations and backache thus produced are frequently mistaken for pelvic disease, though often not associated with any abnormality in that cavity. Constipation due to an enlarged and sacculated colon is invariably present; and, when the organs exhibit also a weakened musculature owing to fatty degeneration of their unstriated muscular coats, we may have profound effects on the general health from absorption of toxins and deficient secretion of the glandular organs. An arrhythmic heart-action even may be traced to this condition.

The most effective treatment known to the author consists in labile applications of electric currents to the weakened and dilated organs of a strength that will induce contraction, as well as profoundly stimulate glandular action. Such currents must be from 100 to 150 milliamperes, which I believe is much more than has heretofore been given in this way, and should be simultaneously combined with the most powerful primary faradic currents, applied from an active pad on the abdomen to the large indifferent pad on which the patient lies, as shown in Plate V, the movements given to the anterior soaped pad resulting in a form of abdominal electro-massage of great service. In addition to following the direction of the colon in these movements, the active pad should be passed down the flanks on each side, just above the pelvic bones, to further reach the motor points of the abdominal muscles.

The powerful currents advised are by no means limited in effect to the abdominal muscles, but constitute also a stimulus to the contraction of the dilated intestines, gradually adding tone by the regeneration of muscular fibre. The galvanic current in this dose can also be relied on to stimulate the secretory and excretory organs of the abdomen, resulting in relief of constipation, general improvement in blood-conditions, and disappearance of irregularities in heart-action. In one case recently under treatment an improvement in the rhythm of the heart could be detected after each application, probably due to direct stimulation of the sympathetic nerves in the epigastric region.

In pronounced cases of abdominal relaxation it will be wise to hasten relief by prescribing a suitable abdominal supporter at once, which may be discarded later as improvement progresses.

CHAPTER XIII.

THE BORDER-LINE BETWEEN GYNECOLOGY AND NEUROLOGY.

THE restriction of the term "gynecology" to the pelvic diseases of woman is largely artificial and often harmful in leading to serious errors of practice. The science of the diseases of woman necessarily includes an account of all of the affections which are either peculiar to her sex or which are so frequently manifested among women as compared with men as to be more or less sequential to their general bodily, mental, and emotional natures. That there is no self-evident line between the strictly pelvic and the extrapelvic affections peculiar to women was manifest to the author many years ago while enjoying, at different times, the valuable privilege of professional association with two of the most prominent practitioners of America in apparently different lines of investigation,—Drs. S. Weir Mitchell and William Goodell,—and it was a singular fact to note that the eminent neurologist was most solicitous that his cases should have the benefit of skilled surgical advice whenever any indications even pointed to this necessity, while the eminent surgeon, at the height of his masterly work in the major surgery of gynecology, had the mental breadth to keep his private hospital filled with patients undergoing what was strictly neurologic treatment, while he might have easily followed the prevailing fashion and removed the ovaries of every one of them.

But the average of professional work or breadth of character cannot be predicated from such men as these, and it is to be feared that like conditions of discernment and cool judgment are often wanting in both specialties, though it cannot be said of the neurologists, at least, that a too-narrow view-point can lead so easily to disaster to the patient.

And, indeed, no more difficult class of cases, from the point of view of their diagnostic classification, can be found in the practice of medicine, and unless the physician has both a gynecic and neurologic facet to his crystallized experience he may make mistakes.

The author particularly recalls a case under his care before the development of his gynecic training where evidences of hysteria were associated with a vulvar discomfort, which could have been none other than a minute caruncle. An imperfect examination was made, but the slight evidence of local disease did not seem to bear an etiologic relation of importance to the very manifest hysteric symptoms existing, and the case was treated entirely from the neurologist's stand-point with but partially satisfactory results. A retrospective review of its management makes it evident that the local affection should have been carefully sought for and remedied simultaneously with the neurologic treatment, care being observed to so adapt and direct the latter that the patient's attention shall be attracted away from an undue contemplation of the local symptoms.

In the management of these cases of manifest hysteroid conditions associated with local disorder or lesion, whether pelvic or extrapelvic, it is clearly our duty to correct the local faults while pursuing measures to eradicate the main affection; but I believe the profession will agree with me that too much stress has been laid upon the so-called "reflex" causes of nervous disease in recent years, though no one can deny the real importance of reflex nerve-strain from a degenerating or badly-functionating organ. Ovarian congestion and tenderness have been specially frequent in these border-line cases, and these organs have been removed time and again for conditions of exaggerated nervous disorder without securing the expected relief, for the simple reason that the ovary was not the seat of the real disease, but merely the spot at which appears the peripheral expression of a centric disease of the nervous system. Such a course of procedure was, moreover, incorrect in the nature of the local remedy applied, for it should not be forgotten that centric disease may be favorably affected by peripheral applications to the end-organs through which it expresses itself, the remedy in these cases not having been a curative removal of the congestion or tenderness, but a violent amputation of a but-slightly-diseased organ, thus adding a distinct blow to an already-unpoised nervous system. In place of such heroic procedures we should substitute the locally alterative action of vaginal electricity, which is capable not only of removing the local congestion or hyperplasia, but, also, of producing a very valuable centripetal effect upon the disordered cerebral centres.

An interesting demonstration of the latter truth is recalled in

the case of a young lady referred to the author some years ago by Dr. Pepper, her home physician reporting that the pain and tenderness in the region of the left ovary had become so great that she was rapidly drifting into the dangers of morphinomania. In addition to the marked hysteric condition present there was distinct bogginess in the region of the ovary complained of. This speedily diminished under positive vaginal treatment with both currents applied by a small cotton-covered electrode and abdominal pad, associated with removal from home surroundings, general electricity, and massage, resulting in complete cure. The local conditions of this case were exactly similar to those of the following cases, both of which were, however, more virulent in their hysteric condition, and ultimately illustrated the fallacy of the theory of a local pelvic origin of this protean disease of the brain.

A young girl, of plain Pennsylvania-German parentage and the picture of wholesome physical girlhood, was the patient of an able practitioner who had long been the family physician. During the serious and finally fatal illness of a younger sister a latent neuropathic diathesis became prominent in this patient, who went through an elaborate mimicry of the traumatic spinal meningitis of which her sister suffered in the same room, and seemed desirous of diverting to herself all the attention of a too-solicitous mother. After various changes in the manifestation of the neuropathy, and many therapeutic efforts on the part of her physician, she was sent to the Infirmary for Nervous Diseases and placed under seclusion, rest, and massage without adequate electric treatment. About this time the patient's attention became fixed on a pain in the pelvis, aggravated at the periods, and her physician finally decided that the removal of the ovaries would be wise, which was successfully done. The pain, however, became worse than ever after the operation, and nearly a year afterward her physician sent her to the author in despair. The uterus was now fixed and extremely tender at the stumps of the ovaries, with probably one or more irritating ligatures in these positions, and the local electric treatment that she was willing to receive was of little avail. Obstinate bowel obstruction gradually developed later, for which a second operation was performed, this operation revealing a post-operative adhesion between the appendix and the stump of the right ovary. The patient failed to rally from this operation, expiring some hours later.

A similar case in some respects was admitted to the sanatorium from Northern Ohio in 1895, the young lady's physician sending her for treatment for an adherent right ovary, which was also enlarged and tender: a diagnosis which had been made by himself and a distinguished surgeon of Cleveland. Fortunately for the possibilities of a fuller diagnosis, the patient's aunt accompanied her to Philadelphia. An examination on admission led me to conclude that the pain complained of in the pelvis was mainly uterine in seat, no considerable periuterine or ovarian disease being manifest. I was, moreover, led to suspect an overwhelming neuropathic taint from a peculiar glitter of the eye which will frequently be found in hysteric cases, and from the very apparent evidences that her family were unsuspectingly fostering her aches and pains: a view of the case that was not shared, at this time, by her physician.

She was placed on combined neurologic and gynecic treatment, consisting of general galvanic treatment, massage, and regulated exercise, and daily vaginal galvano-faradic applications interspersed with weekly intra-uterine applications of the same currents, and was sent home in a greatly improved condition with full directions for a continuance of the methods at the hands of her home physician. This gentleman has kindly informed me since that the methods were not continued, but that laparotomy with removal of the ovaries was performed instead some months afterward, these organs being found normal and free from adhesions. The patient unfortunately succumbed to the operation.

The fact that these two patients died as a consequence of the operative procedures undertaken for their relief is, of course, not in itself a condemnation of the methods or the theories behind them, for in both cases the deaths were caused by accidental circumstances connected with operations that are usually more or less safely performed, though the fact that such possibilities attend a method of treatment of a non-fatal disease should never be lost sight of. But that clearer after-sight that is often more accurate than foresight shows that the disease was disproportionate to the remedy, particularly when we consider what would have been the natural history of the disease if all therapeutic efforts had been withheld, as in the cases of pneumonia studied by the elder Flint many years ago. Undoubtedly both patients would have been still living, so far as the diseases under consideration were concerned. It is likely, also, that

both would have been better by reason of changed internal and external conditions through flux of time, or by reason of the too-indulgent relatives either mending their ways or being worried to death; at any rate they—the patients—would have been living.

But entirely apart from the accidentally-fatal results noted in the two cases, each case indicated in another way that the local conditions were inadequate in themselves to cause the general condition complained of. In the one case the first operation, which was in every way an immediate success, left the patient in an unchanged neurotic condition, to which was added the sufferings from post-operative sequels. In the other case the early fatal result precluded any estimate of the effect of the operation in relieving pain, but by revealing the fact that there was no organic disease or morbid adhesion present the operation clearly indicated that a failure in this respect would have attended an immediately successful result.

A thorough study of cases of this nature conveys several valuable lessons to the thoughtful physician, chief of which is that they, with many other immediately successful cases, demonstrate ultimately the unwisdom of removal of normal ovaries for any form of hysteria. Of castration for curable diseases of these organs reference has been made elsewhere in these pages (page 114).

A second lesson admonishes us to include the patient's relatives in our scheme of treatment when it is impracticable to remove the patient from their influence for a sufficiently long period. In the case treated after the first operation the electric treatment was rendered ineffective by the fact that the patient remained at home during its continuance. In the last case the removal from home influences was a valuable assistance to the treatment employed, and the patient was vastly improved when circumstances rendered it necessary for her to return to surroundings that had been nervously hurtful since her birth. Had it been possible for this patient to have obtained congenial occupation elsewhere, which was suggested at the time, there is no doubt but what a complete restoration to health would have occurred.

The Rest Cure in the Treatment of Hysteria and Hysteroid Affections.—There is no question of the very great value of the "rest cure" in two distinct classes of affections: the hysteroid conditions and physical prostration, sometimes called nervous prostration. Dr. Weir Mitchell, its distinguished originator, conferred a

lasting benefit upon humanity in making this method popular, and it should also be added that great credit in this connection is also due the late Dr. William Goodell, who proved that many so-called uterine affections were of really neurotic origin—"nerve-mimicries of uterine disease" and distinctly curable by this method. That many cases have been subjected to this treatment that were not proper subjects for it, and that it has been imperfectly applied, does not detract from its value when skillfully directed in properly selected cases.

It is probable that the principal failures in the employment of this method have been due not only to improperly selected cases, but to a misapprehension of the method itself. He who imagines that the "rest" is the main feature of the method in any case other than mere physical prostration is far wide of the mark. This convenient and pleasing term is only the name for a most rigid method of treatment, which has as its chief elements the replacement of drug medication by valuable physical methods of affecting the body, associated with a rigid diet and a command of the will-power of the individual. In most cases the rest is a mere incident in the subjection of the patient to more important influences.

I have already said that its chief field lies in the hysteroid conditions, and in these the most rigid application of its rules is most valuable. Without attempting the difficult task of defining these conditions I wish to point out that cases with hypochondriac symptoms are not necessarily hysteroid, but often neurasthenic, as described in the next chapter, and that these cases are poor subjects for the Weir Mitchell method, mainly because the seclusion is harmful. Cases of physical prostration from absolute, not relative, overwork, are also good subjects for the method and respond readily to it.

The chief features of this method, as employed by the author, are: complete removal from accustomed scenes and associates and rest in bed under the care of a specially trained nurse, who screens the patient from all communication with her friends for a definite period, usually at least four weeks. During the first two or three weeks the patient remains at absolute rest in bed, though she may rise to attend the calls of nature in all but the most rigidly treated cases. Massage is given daily in the morning. In the afternoon general galvanic stimulation is applied, preceded by the local electric treatment to the pelvis or to the stomach which may be indicated in the particular

case, and which is often so important when there is evidence of a reflex origin of the nervous symptoms.

The diet during this time is carefully specified, beginning with milk alone, 1 quart per diem, during the first seven days, to which toasted bread is added at meal-times in some cases. During the second week koumiss is taken between meals and cocoa replaces the milk at breakfast and supper. In the third week full diet may be given, followed by 3 to 5 drops of freshly-prepared, chemically-pure nitrohydrochloric acid in 3 ounces of water after meals, the koumiss being continued between meals.

The getting-up, which begins at the end of the third or fourth week, should be very gradual,—at first, a half-hour, once a day, increasing a half-hour each day.

After the patient completes her getting-up she continues the general electric treatment for a time longer, depending on the case, requiring an hour's rest after each daily application, and receives static insulation and breeze from a powerful machine in the other half of the day in place of massage.

CHAPTER XIV.

NEURASTHENIA AND NERVOUS PROSTRATION.

NEURASTHENIA, or the American disease, first described by the late George M. Beard, to whom American physicians owe the rescue of electro-therapeutics from the blighting effects of quackery, has since been the subject of much study and many treatises in several languages, as physicians the world over recognized that its occurrence was by no means limited by political boundaries, nor even by the existence of the environments of a new country. That it is peculiarly a disease of modern civilization, even though described to some extent by Burton in his "Anatomy of Melancholy," published in 1621, is but another way of saying that it is one of the penalties of that evolutionary development under which society is continuously progressing.

Of the exact nature of neurasthenia several views are current, the most reasonable being that it is a symptomatic manifestation of an imperfect performance of all, or nearly all, of the organic functions of the animal life, causing perversion of the nutrition and functionation of the nervous system. Though it may be caused by a sudden mental shock, such a causation is unusual, and the cases in which it occurs are more nearly related to hysteria. The assumption that excessive occupation due to the claims of business or society is a frequent cause is but relatively true, for in a normal condition it is not work, but worry, that tells hardly upon the individual. In the abnormal conditions of alimentation and excretion, which are probably the primary cause of neurasthenia, a persistence in any occupation requiring a high grade of mental work or irregular hours becomes a persistence in relative overwork, though the same exertions may be harmless under more normal conditions.

The view that assigns the many functional derangements of the nervous system comprised in neurasthenia to an autointoxication due to an imperfect performance of the abdominal functions is gaining ground, and is evidenced by the recognition of lithemia, in many cases, in association with the nervous symptoms.

An enumeration of the symptoms of neurasthenia would occupy more space than is available in a work of this nature. Considered as a whole, the subjective symptoms usually display, in a most varied way, a more or less pronounced inability to perform with personal satisfaction the various tasks imposed upon the individual by the necessities of a social existence. Of objective symptoms the most pronounced are due to disordered action of the sympathetic system of nerves, disordered circulation, and general metabolic sluggishness.

In the treatment the main purpose should be to arouse the defective activities of the sympathetic and of the organs under its control. The effectiveness of peripheral applications, such as the cold bath of momentary duration or applications of static electricity, in restoring circulatory and nutritive control, is no argument against the abdominal origin of the malady, as these agencies exert powerful afferent effects on the sympathetic ganglia as well as upon the cerebro-spinal centres of innervation. Of this nature are also massage and electro-motor stimulation of the limbs and body-surface, with the added advantage of a stimulation of the local circulation, nutrition, and tissue-metabolism; but, unless the abdominal sympathetic system is directly reached, the worst of these cases will fail of complete remedial alleviation, and dissatisfaction will result to both patient and physician.

Rest and regulation of the diet added to these peripheral stimulations will do much for some of these cases, but will be lamentably ineffective in others. The importance of rest alone has been enormously overrated of late, so much so, indeed, that hundreds of patients who have done nothing but rest all their lives are put through a costly treatment by their physicians under an inordinate belief in this shibboleth, only to find their neurasthenic symptoms made worse by the burdensome effect of temporary additions of fat, or their hypochondriac symptoms intensified by a prison-like confinement. In Philadelphia alone a number of such cases have leaped from their bed-room windows. The fact that partial rest each day away from home and under the surroundings of a well-regulated sanatorium is a most valuable portion of the treatment will not make rest at the patient's home or in a boarding-house of equal effect. Shorn of its institutional setting, change of surroundings, and the expectancy that occurs when a number of such cases are treated together, this feature of the treatment is as often harmful as useful." Rest and surface treatment in

lounge-ridden cases are much like certain farming observable in neglectful sections of the country where the surface-scratching of superficial farming fails to supplement the fallow rest in producing good crops. In neurasthenia the causal conditions should be stirred from the foundation by appropriate medication and applications to the abdominal sympathetic. Electricity applied directly to the abdominal organs is a most valuable means of accomplishing this, and it should be supplemented by appropriate doses of exercise as well as rest,—the rest to follow each dose of electricity or mechanical exercise.

Electricity has been used for years in this country in the treatment of neurasthenia, but it is to be regretted that its use has partaken so largely of the antiquated Duchenne methods as to be closely analogous to the soil-scratching style of farming referred to and equally imperfect in results. Even when retained in the hands of the physician or an intelligent assistant these methods are merely a surface excitation, and fall far short of the possibilities that have been demonstrated by modern electrotherapy. Unfortunately, the battery is often relegated to the nurse under imperfect instructions, which lessens still further any good results it might give.

Aside from the assumption that an agent of this nature can be employed properly by unskilled persons, the fault of the Duchenne methods of motor stimulation in neurasthenia are: too great a reliance on the limited value of faradic currents; the use of electrodes of inadequate size in the applications to the trunk, resulting in an insufficient current-density at any point beneath the surface-muscles; and failure to apply currents of effective density to the abdominal ganglia and viscera.

The excellent results derived from galvanic currents of 50 to 150 millampères in the utero- or vagino- abdominal applications of the Apostoli method first directed my attention to the value of large electrodes and considerable currents in these conditions. As a result of these gynecic applications, an improved general health is almost invariable, which, though in part due to the control exerted over the growth, must be often largely due to the necessary inclusion of the abdominal structures in the field of the current. Almost as good results in the stimulation of the sympathetic may be gained by placing the indifferent electrode beneath the back, in the shape of a very large wired-cotton pad, and the active one, which should be six or seven inches in diameter, on the abdominal surface. A greater effect is

obtained if the active electrode is given a circular motion, being lubricated by soaping, as all portions of the abdominal contents are thus successively brought under powerful electric stimulation.

The same pads are also useful in the administration of deeply-penetrating faradic currents, which may follow the galvanic stimulation and should be primary; but time and effort may be economized by combining the primary faradic with the galvanic after the galvanic alone has been employed, as this combination is peculiarly powerful as a motor stimulant of relaxed muscular structures of all kinds, giving all the attainable efficiency of faradic currents, while the more valuable galvanic current-action is continued.

The applications to the peripheral motor-sensory apparatus are also best made by the galvanic current instead of the faradic, the patient continuing to lie on the large pad, while the smaller one, which is to be kept negative and well soaped for lubrication, is carried over the motor points of each group of muscles of the limbs in a labile manner, all shock or unpleasant sensations being avoided by the free use of the controller and meter, the former permitting the current to be turned on after the pad is in position and off before it is removed from the limb. Only those muscles that are physiologically associated in action should be included in the same upward and downward strokes of the pad. For full particulars of the mode of applying general galvanic stimulation the reader is referred to Chapter V. As complete motor stimulation of all the voluntary muscles is thus gained as is produced by the faradic current, with a greater stimulation of the peripheral nerves and tissue-metabolism. The sense of exhilaration is more marked than with the faradic current, and greater warmth of the extremities is produced.

With scientifically applied currents as the principal feature of the treatment, other measures are conjoined as required, including massage if the bodily condition is much below normal, rest for an hour after each treatment, nitrohydrochloric acid if the liver is sluggish,¹ and possibly a gentle laxative for a time. In many cases thus treated the diet requires but little attention, for, above all things, we should not pamper the stomach, but rather whip it into obedience. The final result is apt to be a far more lasting acquisition of healthy blood and

¹ I believe that the freshly-prepared C. P. NHCl acid has a far-reaching effect in lithemic conditions, independently of a sluggish liver.

flesh than if the main features of the treatment were rest and over-feeding alone.

In some cases, however, where the nutrition is decidedly at fault, absolute rest may be used with great advantage for a time in connection with the other remedies, but, if the electric treatment be of the kind described, the duration of absolute rest need not be greater than two weeks, to be followed by two or four weeks of the electric treatment under the rest-and-exercise plan before the patient returns to the active affairs of life.

The value of this modification of the "rest cure" has been attested by a number of years' successful employment without a single failure, though previous experience with the rest-and-overfeeding method resulted in a number of partial failures to permanently cure the patient.

Another most valuable systematic treatment of neurasthenia is that by static insulation, the static breeze, and light sparks drawn from the most affected portions of the body. This method is specially recommended by Vigoroux, and probably acts by a general vasomotor and metabolic stimulation. Recovery is often indicated by an increased perspiration under treatment, particularly in cases that presented a suppression of this excretion.

On re-entering active life the former patient should remember that her indisposition was not one that had been acquired accidentally, but was the result of an imperfect response of the vegetative life to the particular environment; and while a continuance of the accustomed mental efforts may be conducive to a healthy will-power, nature admonishes her to seek a broader physical life, and to minimize the effects of artificial surroundings by spending a larger portion of each year in closer communion with itself.

CHAPTER XV.

INSTITUTIONAL TREATMENT.

THE importance of electricity as the chief therapeutic agent in the management of the neuroses and of many chronic disorders of an organic nature; its close association with massage, seclusion from accustomed environment, and other features of the rest-cure method; together with the necessity for costly equipment and special facilities for the application of strong currents in certain physical diseases, render some mention of institutional treatment specially appropriate to these pages.

The practice of medicine is on the eve of evolutionary changes of vast magnitude. Closely associated with witchcraft, divination, and the black art in past ages, it has not been wholly emancipated from superstition even in the present century, in spite of a progress greater than the combined achievements of all preceding ages, for this progress has been largely confined to investigations as to the causation and accurate recognition of disease, and its cure by surgical methods, leaving the extension of knowledge relating to the cure of disease by medical methods in a less advanced condition. The reason for this can only be the vast difference in the facilities offered for good work in these several departments, both in Europe and this country. In the leading European countries the governments directly foster and support investigations relating specially to diagnosis, and in both Europe and America, particularly in the latter, numerous hospital establishments favor the development of surgical art.

The absolute necessity of hospitals for good surgery, and the ease with which charitable institutions may be made available for this work, has resulted in a one-sided development of these establishments, which has rendered them, at times, of but little service to purely medical art.

And there are many reasons why this should be so. A well-ordered charity hospital may do ideal work in surgery, for the master-hand itself may do the brief work that makes for success or failure.

leaving unessential details to less skilled hands; but the medical treatment of a charity case, in its best and most complete form, can rarely be administered by the chief physician without a far greater sacrifice of time than he is able to make. This results in the whole machinery of the hospital being developed in a surgical direction, leaving it but imperfectly adapted for the treatment of any medical cases other than those acutely ill, or in whose cases the mere administration of drugs is sufficient.

The charity hospitals have, therefore, been of but small value in the development of remedial arts as applied to the cure of non-surgical chronic ailments, for, in spite of a full appreciation of the value of drugs in this class of affections, it is not overstating the bare truth to say that they are of but little use. It is to natural forces and other physical agencies, carefully selected and applied by skilled specialists, that we must look for therapeutic advances that shall be commensurate with similar advances in allied fields, and that this may be done it is absolutely necessary that special institutions be created for this particular purpose. It is but a remnant of superstition to rely upon advice and prescriptions when the whole environment of the patient needs remedial adaptation; and this remedial adaptation can only be employed with adequate means and adequate appliances.

Special institutions, thoroughly adapted to particular lines of work, are, therefore, a most necessary adjunct to modern medical progress, and the author looks forward to the time when their value will be as well appreciated by the profession in all chronic affections as the modern hospital is appreciated as a means for good surgery. That the people for whose benefit they will be created already understand the value of institutional treatment is shown by the success of institutions now well patronized by them, some of which were established by uneducated persons.

When this desirable improvement in the care of the non-surgical sick has been fully established, we will no longer be so inconsistent and untrue to our work as to present the spectacle daily witnessed of a physician prescribing mere drugs for well-to-do patients in a back parlor in the morning, which is bare of remedial appliances for the proper treatment of the persons who pay him for the highest expression of his art, and in the afternoon catering to paupers in the splendors of a perfectly-appointed hospital. If the hospital facilities add to the welfare of the charity patient, surely institutional facilities are

equally useful to the more deserving citizen. In reality there is a greater necessity for well-equipped work in battling with the ailments of intellectual beings, aside from the moral obliquity of a civilization that reserves its best services for its defective classes.

The value of institutional facilities is particularly great in the practice of electro-therapeutics, owing to the magnitude of the instrumental equipment required and the necessity for certain classes of applications being performed under such circumstances that the patient may rest in bed immediately afterward. It also permits of a closer attention to details on the part of the chief physician, through an economy of his time, and makes it convenient to associate with the main element of treatment other remedial agencies of great service in this class of cases, such as scientific massage, radiant heat-baths, good nursing; regulation of dietary, rest, and exercise; and the mental medicines of discipline, expectancy, and environment.

CHAPTER XVI.

MATERNAL STERILITY AND IMPOTENCE.

ASIDE from congenital deficiencies and anomalies of development of the essential organs of generation, we have been taught, since the days of Marion Sims, that the chief reason for sterility attributable to the woman is narrowness or flexion of the uterine canal. When it is remembered that the narrowest pin-hole os will admit a sound on careful manipulation which is many times larger than the self-propelling spermatozooid it would seem that this reasoning is inconclusive. It is doubtless to the operative *furor* that the popularity of the stenosis-and-atresia theory of sterility is due, for, since the days of Sims and J. Y. Simpson, practically no form of treatment has been employed except some method of enlargement of the canal. This was at first accomplished by slitting the cervix, producing artificially, in other words, the same lesion for the sewing up of which other costly operations were later devised. Owing to the combined ineffectiveness, morbidity, and mortality of this procedure, it has, of late, been superseded by so-called "dilatation," which is accomplished only by tearing apart the muscular and fibrous tissues that encircle the canal by powerful steel instruments. Only exceptionally has this accomplished a cure of the sterility, while it is, at times, followed by serious consequences in the shape of parametritis and diseased appendages. One case of ectopic pregnancy and a number of instances of uterine and ovarian tenderness have been observed by me after dilatation for this purpose in patients who were free from tenderness previously.

Far more prominent causes of sterility may be found in imperfect participation of the uterus in the sexual orgasm, catarrhal changes in the mucus of the uterus and tubes, and inactive ovaries,—the last two being the most important. A lessened aspiratory action of the uterus, while rendering conception less certain, cannot be a serious impediment, on account of the automobile powers of the spermatozooids. This defect may, however, be materially lessened by the general intrapelvic action of electricity, promoting the nerve-tone of the organs,

particularly of the uterus and ovaries; increasing muscular contractility; and quickening circulation. The method best adapted to accomplish this purpose is the vagino-abdominal galvanic application with covered vaginal electrode, which should be negative, a current of 30 to 40 milliampères being turned on and off, gradually and repeatedly, by the swelling method. This may be supplemented with labile lumbar applications of the galvanic current to the sexual centre of the cord, the patient lying upon the face with a large pad under the abdomen.

Of the toxic effect of altered uterine secretions on the fertilizing cells of the semen there can be no question, and it is in these cases that galvanic electricity applied within the cavity of the uterus is of the greatest service by its alterative action on the secreting surface. Unless the intra-uterine treatment is indicated, also, by marked changes in the mucous membrane, the covered elastic electrode is best as promoting favorable changes in the mucous membrane with least traumatism. It has been my habit to employ the positive pole usually, though the choice of pole for this purpose is open to further investigation to determine whether the normal alkalinity of the uterine mucus should be increased by the negative pole or diminished by the positive pole. Possibly neither effect is important, the results depending rather on the simple excitation of a more normal secretion.

Deficient activity of the ovaries can only be inferred as a cause of sterility in the absence of any demonstrable lesion or more patent defect of functionation on the part of the woman, and, of course, after the question of the possible sterility of the husband has been eliminated. It may or may not be associated with lack of sexual appetence and responsiveness, for many women conceive readily in whom the orgasm is deficient or absent. Any method of treatment that promotes increased activity of the pelvic circulation, such as negative vagino-abdominal applications of either current, may increase ovulation, while the musculo-tonic effect of the galvanic current turned on in the swelling manner repeatedly may do much to lessen a practical maternal impotence from weakened musculature, which is only less disastrous to the conjugal relation than similar conditions in the male.

But few instances of this affection have been placed under my care for the purpose of curing the sterility,—but five in all, in four of which the treatment was successful at some time during a year following the cessation of the treatment, two instances being almost imme-

diate. In one case that was a failure up to the date of her last report to me the ovaries were both prolapsed and the tubes also probably involved in the remnants of an old pelvic inflammation. Her symptomatic condition was, nevertheless, improved.

The slight attention paid to this subject is doubtless due, in part, to a lack of information as to the value of this method and, in part, to the prevalent disinclination of American women for the burdens of maternity. That electricity may cure sterility when the patient only asks that the pelvic pain of uterine inflammation be cured is shown by the table on pages 384-87, where, of thirty-two cases of uterine disease that involved at least temporary or acquired sterility, eight had become pregnant after the treatment when my report was made (September, 1894). In a paper by Apostoli read at the same meeting of the American Electro-Therapeutic Association, as many as eighty cases were recorded as having become pregnant after intra-uterine electric treatment, some of them having conceived shortly after one application. Apostoli does not mention how many of his cases were nulliparous after some years of marriage and, therefore, sterile, but of the twenty-two cases reported *in extenso* in the paper,¹ five were nulliparas. An interesting case of prolonged hemorrhagic metritis in a nullipara, the cure of which was followed by pregnancy, is detailed on page 83.

¹ Transactions of the American Electro-Therapeutic Association, page 371, 1894.

CHAPTER XVII.

ECTOPIC GESTATION AND OBSTETRICS.

Ectopic Gestation.—This accident, which has been proven of late to be of considerable frequency both by the records of carefully conducted post-mortem examinations and the experience of surgeons, is probably even more frequent in occurrence still, as many cases doubtless recover after extraperitoneal rupture without the diagnosis having been made.

It is beyond the scope of this work to enter into a full discussion of the etiology and natural history of ectopic gestation, since the value of electricity as a sole or principal remedy is confined to a certain stage of gestation only,—namely, from conception to the end of the fourth month, after which time the consideration of the affection belongs exclusively to the surgeon. During these early months, nevertheless, the electric treatment is clearly the method of choice, since it has been established by many competent observers that at this time the ovum may be devitalized and its complete absorption secured by this means, without subjecting the patient to the dangers and uncertainties of abdominal section.

Lawson Tait's classification of ectopic pregnancy, which is generally received, is as follows:—

- I. Ovarian, possible, but not proved.
- II. Tubal, in free part of tube, is
 - (a) Contained in tube up to fourteenth week, at or before which time primary rupture occurs, and then progress of gestation is directed into
 - (b) Abdominal or intraperitoneal gestation; uniformly fatal (unless removed by abdominal section), primarily by hemorrhage, secondarily by suppuration of the sac and peritonitis.
 - (c) Broad ligament, or extraperitoneal, gestation, which

- (d) May develop in broad ligament to full term and be removed at viable period as living child.
 - (e) May die and be absorbed as extraperitoneal hemothecle.
 - (f) May die and suppurating ovum be discharged at or near umbilicus, or through vagina, bladder, or intestinal tract.
 - (g) May remain quiescent as lithopedion.
 - (h) May become abdominal or intraperitoneal gestation by secondary rupture.
- III. Tubo-ovarian, or interstitial, is contained in part of tube embraced by uterine tissue, and, so far as is known, is uniformly fatal, by primary intraperitoneal rupture (as b), before fifth month.

From this it will be seen that the question of electric treatment is concerned only with Class II (a), unruptured tubal pregnancy before the fourteenth or sixteenth week, and with the same condition after early rupture into the broad ligament, where it continues to develop, as in II (d). Tubal pregnancy is, by far, the most frequent form, and its early diagnosis becomes, therefore, a matter of great importance, though attended with much difficulty. Indeed, the possibility of diagnosis before primary rupture of the sac into the broad ligament, which occurs at about the fourteenth week, has been denied by some authorities, yet a reasonably certain diagnosis has been made by both surgeons and electro-therapeutists in many instances of late, some of them of sufficient certainty to warrant the surgical removal in the absence of proper electric treatment and all of them certain enough to warrant the electric treatment, which would be equally applicable to most of the conditions for which it could be mistaken. And herein lies one of the two chief advantages of electricity at this stage of ectopic gestation. Given a reasonable presumption that the case is one of tubal or intraligamentous pregnancy, the physician is not compelled to take the horrible responsibility of counseling a possibly unnecessary unsexing operation in a young wife, but, with a full recognition of the possible gravity of the case, may subject her only to the discomfort of *absolute rest in bed* for one or more months, and daily applications of a method that will kill the fetus if one be present, and subsequently promote absorption of the ovum and surrounding

congestion, and, if the case is not one of ectopic gestation but a suddenly enlarged tube from inflammatory congestion, an ovaritis, or a small fibroid, will be equally effective in arresting progress and contributing to a future cure. The laudable object of verifying the diagnosis is secondary to the best interests of the patient, and in this case the patient's true interests point to the avoidance of the operation if the trouble can be cured without it, whether its true nature is ever proved or not.

The selection of electricity as the appropriate treatment is narrowed down, as before stated, to two stages in tubal pregnancy: (1) before rupture into broad ligament at or about the fourteenth week; (2) after rupture into broad ligament.

Diagnosis of Tubal Pregnancy Before Rupture.—Unfortunately, there are too often no symptoms to alarm the patient, or even to cause her to suspect pregnancy, until the onset of primary rupture of the sac into the tube, and this is not so surprising, when it is remembered that no small proportion of cases occur in those newly married, and therefore unfamiliar with the subjective symptoms of pregnancy, and in others who have been sterile so long as not to be looking for such a contingency. Such cases, moreover, are liable to have long felt some discomfort in the pelvis from latent catarrhal disease of the uterus or tubes, which is possibly an important etiologic factor in the arrest of the ovum in the tube. The symptoms at this stage, if any be noted, are likely to be those of a normal pregnancy, *usually accompanied by a continuance or even more frequent and abundant menstruation*. More positive symptoms may, however, cause the patient to consult her physician, and these are the colicky paroxysms, attributed by Parry to contractions of the cyst. By others they have been attributed to minute hemorrhages. More likely they are merely the neuralgic expression of an unaccustomed and growing tension of the tube, the universal habit of sensory nerves being the explosive expression of a continuous tension or irritation. While the habit of examining all women in the early months of even supposedly normal pregnancy should be aimed at as a routine measure, the physician should invariably make an examination by touch when pain of this nature is complained of.

On bimanual examination, which, in a suspected case, should be as gently conducted as is consistent with a thorough mapping out of the pelvic contents, a soft, elastic, semifluctuating tumor will be

found in the region of the tube, on one or other side of the fundus, corresponding, in size, to the development of the ovum. This mass is quite evidently cystic to the educated touch and is usually more tender than any other cystic tumor with which it can be confounded. The cervix will present the softening peculiar to pregnancy, but the uterus will be found to be smaller than it should be at a corresponding period of normal pregnancy.

Such are the presumptive signs of a tubal pregnancy prior to rupture. Though abdominal sections have been performed on the strength of diagnoses so arrived at, and the condition at times verified, there is grave reason to doubt that the diagnosis can be sufficiently certain before operation to warrant so extreme a measure. Indeed, cases have been recently reported where the finding of slight traces of bloody serum near the tube was accepted by the operator as justifying the operation, even when no other evidence of the ovum could be found. Fortunately, these views were combated at a meeting of the New York Obstetrical Society by Dr. A. Palmer Dudley,¹ who explained that similar conditions had been found by him in operations during menstruation in the absence of any kind of pregnancy. The gravity of the conclusions that lead a surgeon to perform a dangerous operation resulting inevitably in castration on a young wife of a few weeks or months is by no means slight, and when this grave risk and abhorrent results are deliberately preferred to electric treatment, with the abundant testimony in its favor at this stage of the disease, the conduct of the surgeon savors of malpractice, and should be condemned by all honest physicians. And this may even be said of a case where the presumptive evidence of an unruptured tubal pregnancy is very strong, as there is, at this stage, no reason whatever why complete absorption should not follow electric feticide, permitting the tube even, and surely the ovary, to be subsequently brought into a healthy condition under vaginal applications.

There is, on the contrary, no contra-indication to electricity whether the diagnosis be certain or uncertain. If it is a case of tubal pregnancy it may be cured in this way. If it be not, no harm is done by the treatment, which may even be equally adapted to the actual diseases present, such as a salpingitis with exudation,

¹ New York Gynecological and Obstetrical Journal, page 109, July, 1896.

or a non-purulent enlargement of the ovary. Both of these conditions are, in fact, relieved with such certainty by vagino-abdominal galvanic and faradic currents as to frequently leave the physician in doubt as to the true nature of the disease; but surely no sane woman would wish an abdominal section to satisfy a scientific inquiry of no concern to her. Such ignorance can surely be borne in connection with the bliss of restored health, plus the retention of important functions, when wisdom is purchased at such a cost.

Diagnosis of Tubal Pregnancy At and After Rupture.—After rupture of the sac has occurred the diagnosis is far easier to make than before rupture. A sharp, agonizing pain in the pelvis, accompanied by more or less collapse,—anxious expression, fainting, cold and pallid skin bedewed with a cold perspiration, and a rapid and feeble pulse becoming imperceptible,—betokens a rupture into the peritoneal cavity if an antecedent history of presumptive pregnancy can be obtained and the pelvic examination coincides. The physical signs of intraperitoneal rupture obtainable by touch are not so well marked as when the rupture is into the broad ligament. The mass at one side of the uterus is boggy and usually less in size than previous to rupture. When the rupture is into the broad ligament a tense, exceedingly painful tumor is found on one side of the uterus, usually pressing the latter to the opposite side of the pelvis.

To determine whether the case is suitable for electricity or must be at once consigned to surgery it is important to distinguish between a rupture into the peritoneal cavity or into the broad ligament. The former produces the more profound shock and collapse, and on vaginal examination a less prominent tumor is found. The latter is accompanied by less shock and presents a more rounded, tense, and prominent tumor. In either case a flow from the uterus may exist, simulating abortion, from which it is to be distinguished by the smaller size of the uterus, the possibility of, at times, making out a sulcus between the tumor and the fundus, and finally by finding the uterus empty should it be thought necessary to sound it. Additional causes of error are confounding it with rupture of another viscus, hemothecle or hematoma from other causes, or a violent attack of hysteria.

Should the condition of the patient indicate that the hæmorrhage is into the abdominal cavity instead of merely within the layers of the broad ligament no time should be lost in having the

abdomen opened and the bleeding-points tied by a competent abdominal surgeon. The whole question of the use of electricity hinges, therefore, on the presence of free bleeding into the abdomen.

Electric Treatment.—As before remarked, the purposes of the electric treatment are twofold: to kill the fetus and to cause its absorption. To accomplish the former powerful currents are required, which should always be turned on gradually with the controller, and in the case of the galvanic current it is best to employ galvanic alternatives, the internal electrode being alternately positive and negative. The current should be turned on gradually, held for two minutes, turned off gradually, the polarity reversed without removing the electrode, and the procedure repeated with the current in the opposite direction. The ordinary vagino-abdominal method (page 56) is employed, a cotton-covered vaginal electrode being pressed against the tumor in the vagina, with a large, moist, clay pad or other efficient dispersing-electrode on the abdomen. Faradic currents, which should preferably be the primary of a powerful coil, are thought to be best by some, and it is therefore wisest to use both currents, one after the other, at least once daily until the sac shrinks and becomes less tender. The same treatment should then be continued at greater intervals and less dosage until absorption seems well under way.

The galvanic dosage should be from 100 to 150 milliamperes and the faradic to point of endurance, all possibility of shocks being eliminated, particularly if rupture into the broad ligament has occurred.

Dr. A. Brothers, of New York, has made a careful statistical study of the cases reported in medical literature, and his last paper¹ on the subject deserves to be quoted in full as presented to the American Electro-Therapeutic Association in September, 1893:—

“First employed in Italy by Bachetti in 1853, and later by Braxton Hicks in England in 1866, the electric method of treating ectopic gestation was first resorted to on this side of the Atlantic by Allen, of Philadelphia, in 1869, and has since remained almost a purely American plan of treatment. In the paper which I wrote, five years ago, for *The American Journal of Obstetrics* (May, 1888)

¹ “Present Position of the Electric Treatment of Extra-uterine Pregnancy,” Transactions of the American Electro-Therapeutic Association, page 170, 1893.

I collected statistics of forty-three cases treated by electricity, with one death. In a paper published two years later, on the "Subsequent Behavior of Cases Treated by Electricity,"¹ I found that the twenty-five cases which I had been able to trace were doing well after a lapse of one to eight years, and that none of them had been compelled to undergo secondary operations. Many of these patients still carried traces of the old trouble, but without perceptible inconvenience.

"Within the last few years the epidemic of laparotomy fever which originated in Europe has infected our shores and spread over our continent to such an extent as to temporarily displace this treatment from the position it properly deserves. As a result, the literature of the past few years shows a smaller number of cases published than we should expect from the past success of this treatment, although a small band of able practitioners continue to adhere to their convictions and employ it, under judicious restrictions, wherever it is properly indicated.

"To bring this subject down to the present I have reviewed the literature at my command, and am thus enabled to present the table on pages 224 and 225.

"I have therefore been able to find records of eighty-five cases of extra-uterine pregnancy in which electricity was employed to destroy the fetus. I do not regard this as a complete list, for some cases have been overlooked and others have not been published. It is sufficient, however, to show that the method has been pretty extensively employed.

"In two cases (60 and 61) the treatment apparently failed in the hands of very able men (Coe and Wenning), but subsequent laparotomy showed the diagnosis to have been faulty, for in both cases the gestation was intra-uterine. Coe saved his patient after she aborted, but Wenning, who had resorted also to aspiration, was unfortunate in losing his. In Case 81, that of Lewis, electricity was discarded and abdominal section performed, resulting in recovery.² In one of Blackwood's cases the extra-uterine mass had shrunk two

¹ The American Journal of Obstetrics, 1890, volume xxiii, page 113.

² The cause for discarding electricity in Lewis's patient was a fear that the case was a normal pregnancy. There was no need of the subsequent laparotomy, as absorption of the fetus was partially complete.—G. B. M.

years later to one-half its original size, and he was in favor of galvanism to further its absorption. The patient, however, was advised by a specialist to submit to laparotomy, from which she died. In none of these cases can the electric treatment be accused of having done any harm.

"Collapse during the administration of the current has occurred in the cases of Mundé (23), Janvrin (34), and Coe (54); but only one case—that of Janvrin (34)—proved fatal. In two of Blackwood's cases (70 and 71) the symptoms of internal hemorrhage due to partial rupture—shock, faintness, debility, etc.—were present, but the doctor writes me that the cases made favorable recoveries.

"Aspiration was resorted to in three cases in connection with electricity by Braxton Hicks (2), Lusk (30), and Wenning (61). Hicks and Wenning lost their patients,—the latter supplementing the procedure by laparotomy,—but Lusk saved his case after assisting the discharge of the fetus through a vaginal rent.

"The fetus was displaced from the tube into the uterine cavity in five cases,—those of McBurney (6), Garrigues (29), Blackwood (74), Grandin (83), and Carriker (84).

"The case of Landis (5 and 11) is unique in that the same patient suffered twice from extra-uterine pregnancy, but was in each instance successfully treated by electricity.

"In Westcott's case (17) the extra-uterine pregnancy was associated with normal pregnancy, which was not disturbed by the treatment, and Bierwirth's patient (52) was suffering from typhoid fever while undergoing the same treatment.

"The fetus was expelled through vaginal or rectal rents in four cases,—those of Lusk (30), Chadwick (39), and Blackwood (72 and 73). These patients ultimately recovered.

"Only one death—that of Janvrin's patient (34)—has occurred in seventy-eight cases in which electricity was employed without puncture, and in this case there were marked symptoms of hemorrhage previous to the resort to electricity.

"The nature of the current used has varied. In twenty-seven cases faradism was used, in twenty-five cases galvanism, either current (not stated) in nine cases, both currents successfully in sixteen cases, galvano-puncture in seven cases, and static electricity in one case.

"Of the seven cases treated by electro-puncture, there were five

recoveries and two deaths. This proves electro-puncture to be a very dangerous method, the bad results being undoubtedly due to the puncture and not to the current. Similar bad results have followed the use of simple puncture with aspiration or followed by the injection of drugs. In my first paper I referred to fourteen cases of failure or death after the use of simple tapping or injection of drugs.

"Although the electric treatment has been chiefly employed in our own country, my table shows the interesting fact that it has also been used five times in Russia, five times in England, and once in Italy, Canada, Germany, France, and Australia.

"It may be interesting to quote, at this point, the most recent views of many of the best authorities regarding this plan of treatment. Playfair¹ says: 'This practice is perfectly safe, and there can be no rational objection to its being tried.' Lusk, in the last edition of his work on 'The Science and Art of Midwifery' (New York, 1892), says: 'The danger which threatens the life of the patient is often imminent, and assistance from afar is not always easy to obtain. Under these conditions the indication for treatment is plainly the adoption of measures to destroy the life of the fetus, and thus, by arresting the growth of the ovum, to diminish the chances of rupture and hemorrhage.' In a personal interview with Professor Lusk he stated that he was as much interested in the electric treatment as ever, but lately had met cases in which hemorrhage had already occurred and which required operative interference. He was perfectly convinced of the efficacy of electric treatment in suitable cases, and was perfectly sure that in the cases in which he had successfully resorted to it there was no possibility of a mistake in diagnosis.

"Prof. T. G. Thomas, early in the summer (of 1893), also stated that he was as firm a believer in the treatment of these cases by electricity as ever. In Thomas and Mundé on 'Diseases of Women' (Philadelphia, 1891) it is stated: 'At one extreme stand able and conservative practitioners, who appear to favor the position that, as a very general rule, we should stand calmly by with folded arms and accept without effort or resistance the terrible chances of death which attend these cases. At the other we see enthusiastic ones, with strong surgical proclivities, who would apparently resort to laparotomy in

¹ "A Treatise on the Science and Practice of Midwifery," London, 1889.

TABLE OF CASES OF EXTRA-UTERINE PREGNANCY TREATED BY ELECTRICITY.

No.	Case of	Reported in	Current.	Nationality.	Result.	Remarks.
1.	Bachetti	Trans. Am. Gyn. Soc., 1882	Electro-puncture	Italy	Recovery.	
2.	Hicks	Trans. Am. Gyn. Soc., 1882	Faradism.	England	Death.	Puncture later caused death.
3.	Allen	Trans. Am. Gyn. Soc., 1882	Faradism.	U. S.	Recovery.	
4.	Allen	Am. Jour. of Obst., 1872, vol. v	Faradism.	U. S.	Recovery.	
5.	Landis	Ohio Med. and Surg. Jour., Oct., 1877	Faradism.	U. S.	Recovery.	
6.	McJurney	N. Y. Med. Jour., March, 1878.	Galvanism.	U. S.	Recovery.	Fetus discharged through vagina.
7.	Reeve	Trans. Am. Gyn. Soc., 1879	Faradism.	U. S.	Recovery.	
8.	Harrison	Trans. Am. Gyn. Soc., 1882	Faradism.	U. S.	Recovery.	
9.	Lusk	Am. Jour. of Obst., April, 1881	Faradism.	U. S.	Recovery.	
10.	Wilson	Trans. Am. Gyn. Soc., 1882	Faradism.	U. S.	Recovery.	Same case as No. 5.
11.	Landis	Med. News, August 8, 1882	Faradism.	U. S.	Recovery.	
12.	Hillington	Trans. Am. Gyn. Soc., 1882	Galvanism.	U. S.	Recovery.	
13.	Pinnet	Am. Jour. of Obst., Feb., 1882	Faradism.	U. S.	Recovery.	
14.	Garrigues	Am. Jour. of Obst., Sept., 1882	Faradism.	U. S.	Recovery.	
15.	Herrick	Trans. Am. Gyn. Soc., 1882	Galvanism.	U. S.	Recovery.	
16.	Hochmann	Allg. med. Centrztg., April, 1883	Static electricity.	Germany	Recovery.	
17.	Westcott	Beard and Rockwell's "Electricity"	Galvanism	U. S.	Recovery.	Normal pregnancy not disturbed.
18.	Rockwell	Beard and Rockwell's "Electricity"	Galvanism	U. S.	Recovery.	
19.	Sims	Beard and Rockwell's "Electricity"	Galvanism	U. S.	Recovery.	
20.	Cushier	Trans. Am. Gyn. Soc., 1881	Faradism.	U. S.	Recovery.	
21.	Cocks	Trans. Am. Gyn. Soc., 1881	Galvanism	U. S.	Recovery.	
22.	Lambert	Trans. Am. Gyn. Soc., 1881	Faradism.	U. S.	Recovery.	
23.	Mundé	Am. Jour. of Obst., Oct., 1881	Galvanism, later galvanism	U. S.	Recovery.	
24.	Borlin	Bost. Med. and Surg. Jour., Sept., 1884	Galvanism, later faradism	U. S.	Recovery.	Collapse after first application.
25.	Sibbald	Polyclinic, 1884, No. 15	Galvanism	U. S.	Recovery.	
26.	Briggs	Med. News, July 11, 1885	Faradism.	U. S.	Recovery.	
27.	Stoddard	Med. News, July 11, 1885	Faradism.	U. S.	Recovery.	
28.	Lusk	Am. Jour. of Obst., Aug., 1885	Faradism.	U. S.	Recovery.	
29.	Garrigues	Med. News, Dec. 12, 1885	Faradism.	U. S.	Recovery.	Fetus expelled into uterine cavity. Also puncture. Fetus removed through vaginal rent.
30.	Lusk	Med. Rec., Jan. 23, 1886	Faradism.	U. S.	Recovery.	
31.	Gaulet	Med. Rec., June 26, 1886	Galvanism	U. S.	Recovery.	
32.	Aveling	Br. Med. Jour., Dec. 4, 1886	Faradism.	England	Recovery.	
33.	Gardner	Br. Med. Jour., Dec. 4, 1886	Faradism.	Canada	Recovery.	
34.	Janvier	Trans. Am. Gyn. Soc., 1886	Galvanism	U. S.	Death	Fatal result after third application.
35.	Petch	Br. Med. Jour., Dec. 4, 1886	Galvano-puncture	England	Recovery.	
36.	Trush	Am. Jour. of Obst., Dec., 1886	Faradism.	U. S.	Recovery.	
37.	Van de Warker	Trans. Am. Gyn. Soc., 1887	Faradism.	U. S.	Recovery.	
38.	Sims	Annals of Gyn., Jan., 1888	Galvanism	U. S.	Recovery.	
39.	Chadwick	Trans. Am. Gyn. Soc., 1887	Galvanism	U. S.	Recovery.	Fetus extracted through vaginal rent.
40.	Mann	Med. News, July 11, 1885	(?)	U. S.	Recovery.	
41.	Page	Am. Jour. of Obst., April, 1887	Galvanism	U. S.	Recovery.	
42.	Harrison	Am. Jour. of Obst., April, 1887	Galvanism	U. S.	Recovery.	
43.	Brothers	Am. Jour. of Obst., May, 1888	Faradism.	U. S.	Recovery.	

TABLE OF CASES OF EXTRA-UTERINE PREGNANCY TREATED BY ELECTRICITY (*concluded*).

No.	Case of	Reported in	Current.	Nationality.	Result.	Remarks.
44.	Taylor	Med. Rec., June 29, 1889	(Galvanism)	U. S.	Recovery.	
45.	Walker	Med. Rec., Nov. 16, 1889	Faradism	U. S.	Recovery.	
46.	Galabin	Arch. de Toccol., xvi, 1889	(Galvano-puncture)	France	Recovery.	
47.	Kletzsch	Am. Jour. of Obst., 1888, xxi	Faradism	U. S. (?)	Recovery.	
48.	Buckmaster	Med. News, 1888, lili	(Galvanism)	U. S. (?)	Recovery.	
49.	Duncan and Stevenson	Br. Gyn. Jour., 1888	Faradism, later galvanopuncture	England	Death.	
50.	Bolton and Stevenson	Br. Gyn. Jour., 1888	Electro-puncture	England	Death.	
51.	Henton	Gaillard's Med. Jour., 1888	Faradism	U. S.	Recovery.	
52.	Bierwirth	Gaillard's Med. Jour., 1888	Faradism	U. S.	Recovery.	
53.	Edelohls	Med. Rec., Dec. 7, 1889	Faradism	U. S.	Recovery.	Complicating typhoid fever.
54.	Coe	Am. Jour. of Obst., 1890	Faradism	U. S.	Recovery.	Sac ruptured. No laparotomy required.
55.	Hanks	Am. Jour. of Obst., 1890	Faradism (?)	U. S.	Recovery.	
56.	McLean	Am. Jour. of Obst., 1890	Faradism (?)	U. S.	Recovery.	
57.	Coe	Am. Jour. of Obst., 1890	Faradism	U. S.	Recovery.	
58.	Wenning	Am. Jour. of Obst., 1890	Faradism, later galvanism	U. S.	Death	Laparotomy showed normal pregnancy. Aspiration later, then laparotomy; dextro-torsion of uterus found.
59.	Blackwood	Correspondence	Faradism, later galvanism	U. S.	Death	Laparotomy done two years later with fatal result.
60.	Blackwood	Correspondence	Faradism, later galvanism	U. S.	Recovery.	Previous rupture of sac.
61.	Blackwood	Correspondence	Faradism, later galvanism	U. S.	Recovery.	<i>Dibris</i> discharged through rectum.
62.	Blackwood	Correspondence	Faradism, later galvanism	U. S.	Recovery.	<i>Dibris</i> discharged through vagina. Fetus expelled into uterus.
63.	Blackwood	Correspondence	Faradism, later galvanism	U. S.	Recovery.	
64.	Blackwood	Correspondence	Faradism, later galvanism	U. S.	Recovery.	
65.	Blackwood	Correspondence	Faradism, later galvanism	U. S.	Recovery.	
66.	Blackwood	Correspondence	Faradism, later galvanism	U. S.	Recovery.	
67.	Blackwood	Correspondence	Faradism, later galvanism	U. S.	Recovery.	
68.	Blackwood	Correspondence	Faradism, later galvanism	U. S.	Recovery.	
69.	Blackwood	Correspondence	Faradism, later galvanism	U. S.	Recovery.	
70.	Blackwood	Correspondence	Faradism, later galvanism	U. S.	Recovery.	
71.	Blackwood	Correspondence	Faradism, later galvanism	U. S.	Recovery.	
72.	Smouse	Trans. Iowa Med. Soc., 1890	(Galvanism (?))	U. S.	Recovery.	
73.	Martin	Austr. Med. Gaz., vol. ix	Faradism	Australia	Recovery.	
74.	Nedzwetsky	Ann. de gyn. et d'ob., 1890, xxxiii	Galvanism	Russia	Recovery.	
75.	Nedzwetsky	Ann. de gyn. et d'ob., 1890, xxxiii	Galvanism	Russia	Recovery.	
76.	Nedzwetsky	Ann. de gyn. et d'ob., 1890, xxxiii	Electro-puncture	Russia	Recovery.	
77.	Nedzwetsky	Ann. de gyn. et d'ob., 1890, xxxiii	(Galvanism, later electro-puncture)	Russia	Recovery.	
78.	Nedzwetsky	Ann. de gyn. et d'ob., 1890, xxxiii	Faradism (?)	U. S.	Recovery.	Electricity discarded and laparotomy performed.
79.	Nedzwetsky	Ann. de gyn. et d'ob., 1890, xxxiii	Galvanism	U. S.	Recovery.	Fetus expelled into uterus.
80.	Kalabine	Ann. de gyn. et d'ob., 1890, xxxiii	Galvanism	U. S.	Recovery.	Fetus expelled through vagina.
81.	Lewis	Trans. Col. Phys. Phila., 1891	Faradism (?)	U. S.	Recovery.	
82.	St. John	Jour. Am. Med. Assoc., 1892	Galvanism	U. S.	Recovery.	
83.	Grandin & Cole	N. Y. Jour. Gyn. and Obst., 1892	Galvanism	U. S.	Recovery.	
84.	Carriker	Elect. Med. Jour., 1892	Galvanism	U. S.	Recovery.	
85.	Nedoroff	Index Medicus, 1892	Galvanism	Russia	Recovery.	

every case in which diagnosis is possible. On a middle ground, one lying between these extremes, the truly conservative surgeon will find his appropriate position.'

"Although Pozzi in his 'Treatise on Gynecology' (American edition, 1892) condemns the use of electricity, the able editor of this work (B. H. Wells), quoting Byford, says: 'If we have a case of extra-uterine pregnancy in the early months it is safe to destroy the fetus by electricity and keep the patient in bed until absorption has noticeably commenced. If profuse, repeated hemorrhages occur, it is safer to operate at once.'

"Parvin¹ says: 'Throwing aside all doubtful cases, there remains a strong argument from actual experience in favor of the treatment of ectopic gestation, prior to the rupture of the fetal cyst, by electricity.'

"The works on electricity in its relation to gynecology by A. H. Goelet,² and Grandin and Gunning,³ are likewise strongly in favor of the employment of electricity in the treatment of early cases of ectopic gestation. Byford, Mann, Skene, Wilson, and many other eminent specialists in gynecology have also in recent times expressed themselves in favor of this plan of treatment.

"The Boston Medical Society, at its meeting held on November 12th, 1892, received the report of the chairman of a committee appointed to investigate the present condition of medical opinion with regard to the subject of extra-uterine pregnancy.⁴ The report reads: 'Immediate celiotomy, so soon as the diagnosis is established, is then, in the judgment of your committee, the only treatment which should be considered before rupture of the tube.' If the gentlemen of this committee can spare the time to review the facts gathered in this paper, they may charitably allow a small place, at least, for the treatment of some of these cases by electricity. The fact is, in spite of the highly moral position taken by Lawson Tait, that feticide in extra-uterine pregnancy is considered justifiable in the interests of the mother by a great many practitioners. It is also a fact, which this paper proves, that, beyond one death in seventy-eight cases, no

¹ "Science and Art of Obstetrics," Philadelphia, 1890.

² "The Electro-therapeutics of Gynecology," Detroit, 1892.

³ "Practical Treatise on Electricity in Gynecology," New York, 1891.

⁴ E. Reynolds, Boston Medical and Surgical Journal, January, 1893, volume cxxviii, page 107.

injury has ever been done by the use of electricity, and where it has been directly abandoned for laparotomy no harm was done by the previous treatment. The treatment has maintained its reputation for harmlessness; and although, in the eyes of some, it has been dubbed 'ridiculous' and 'cowardly' and the product of 'ignorant obstinacy,' it continues to assert itself as a simple, innocent procedure which has its own proper sphere of usefulness."

Dr. Brothers's list is, in itself, sufficient to establish both the possibility of electric feticide and the advisability of its employment in the class of cases recommended in this chapter; but, when considering it as a record of the cases of this nature, we should remember that many other patients have been cured under vaginal galvanic applications which were possibly instances of extra-uterine pregnancy, but where diagnosis was too uncertain to permit them to be conscientiously reported as instances of this affection.

Abortion.—From what has been said in the preceding paragraphs it is evident that in electricity we have a feticide of positive and definite value which, when applied within the uterus, is certain to arrest the life of the embryo in those cases where a consultation determines the necessity for so terminating the pregnancy. The negative pole of the galvanic current is preferable, as it attracts moisture by cataphoresis and excites flow, the current-strength being from 30 to 75 milliamperes, applied on a carefully aseptitized sound-shaped electrode insulated beyond the internal os. Five minutes is a sufficient duration every other day for a week, when it will be found that the ovum is so reduced in size and detached as to readily pass away with but moderate uterine contraction. The first applications are best made with the elastic instrument (Fig. 33), even cotton-covered, as by this instrument the chances of puncturing the ovum are diminished and the likelihood of its expulsion entirely increased. A few faradic applications subsequently will hasten involution.

Hyperemesis Gravidarum.—Among the many useful remedies for the excessive nausea and vomiting of pregnancy none is more certain than the application of a fine-wire faradic current to the solar plexus at the epigastric region. The anode should be placed at the back of the neck and the cathode, or negative pole, at the pit of the stomach, carefully avoiding the uterine region. The special value of this procedure, which is confined to fine-wire currents, is the direct sedation produced by it, though certain cases require instead that the sympa-

thetic nerves in this situation should be stimulated by galvanic currents of 15 to 30 milliampères applied from pads placed in the same position. Either of these procedures is likely to succeed in cases where everything else fails, rendering the induction of artificial abortion unnecessary.

Use of the Faradic Current in Labor.—This is a subject of vast importance to the practicing obstetrician, for by this much-neglected means a too-slow labor may be hastened, atony of the uterus corrected, post-partum hemorrhage instantly controlled, and involution so hastened by a few, or at times only one, applications, as to materially lessen the lying-in period.

Suggestions of this nature were made a number of years ago

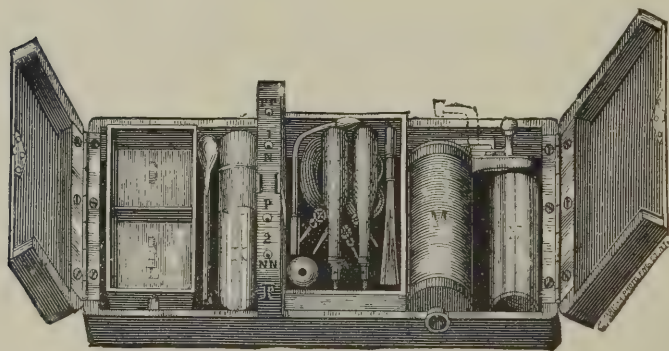


Fig. 64.—Gaiffe's pocket faradic battery. The exciting fluid is made in a few moments from bisulphate of mercury carried in a bottle (*K*) in a dry state, a spoonful of which is to be added to each of the cells (*L*), water added, and the zincs replaced.

by Tripier, and more recently by Dr. W. T. Baird, of Texas, and Dr. R. J. Nunn, of Savannah, Ga.; yet, doubtless owing to the fact that the busy *accoucheur* has no battery with him in the lying-in chamber and if he sends to his office for it finds it out of order, but little use seems to have been made of these suggestions. Bearing in mind that it is the faradic current only that is of service at this time, the remedy for this practical difficulty is the addition to the regular contents of the obstetric bag of a small Gaiffe battery (Fig. 64), which is inexpensive and always ready for use, for the solution employed is made instantly by the addition of a little water to a

spoonful of the bisulphate of mercury carried in the battery-case. A more powerful coil is, at times, of greater service, but, as the principal obstetric uses of the faradic current are due to its contractile power, the primary coil of the Gaiffe battery should be employed and the resistance of the circuit diminished by having the external pole or poles increased in size by a folded towel well wetted with a solution of table salt. It should not be overlooked, also, that in all houses that are lighted by the Westinghouse alternating system (page 352), we have an excellent faradic current at hand by simply unscrewing a lamp and placing a Massey or Jewell controller in circuit with the patient, when a current of any strength is obtainable by turning the crank to a point that gives perceptible results.

Inertia Uteri.—The contracting power of the faradic current is not entirely barred by the presence of the child in the uterus, for, if the usual head presentation exists and inertia of the uterus occurs in spite of a well-dilated cervix, we may apply the electrodes (either ordinary disk-electrodes or, preferably, pads about the size of the palm of the hand) on either side of the fundus near the navel, and turn the current on forcibly at the inception of each pain, or about the time the pain should appear, turning it off at each intermission and repeating the procedure regularly for a time. This will not endanger the heart or respiration of the child, being too far from these vital organs, and will usually soon produce such vigorous contractions that the forceps may be left untouched while time is saved to the physician and much suffering saved to the patient. My own limited experience agrees with the statement of Dr. Baird, that the turning on of the current synchronously with the pains very materially lessens the suffering of the patient, even in normal labor, while at the same time the expulsive forces are re-enforced.

Post-partum Hemorrhage.—When this alarming accident is due to inertia of the uterus, which fails to contract properly and promptly after delivery of the placenta, there is nothing equal in immediate and thorough results to the primary or coarse-wire faradic current applied with a bipolar electrode within the uterus or a single active pole in that situation and the other on the abdomen. The bipolar electrode (page 66) should be of the kind capable of thorough asepsis, preferably in the flame of the alcohol-lamp, and the monopolar electrode should be blunt and properly insulated and asepticated. In an emergency where such instruments are inaccessible an intra-uterine elec-

trode may be improvised for so large a cavity from a piece of wire about a yard long and a piece of rubber tubing a foot or eighteen inches long, in the following manner:—

Bare a considerable portion of the wire, if covered, and bend this end in a long loop; twist and fold the end of the loop into a ball that will project beyond the end of the rubber tube when it is passed through it, one end of the wire remaining within the tube and the other end being brought out at the opposite end of the tube and twisted around the tip of a conducting-cord, to make connection. The whole should now be immersed in boiling water for a few moments to insure cleanliness, after which the knobbed end may be inserted into the cavity and the instrument connected with one cord of the battery. The other electrode is placed on the abdomen and, if only an ordinary disk-electrode, may be increased in size by putting a folded napkin beneath it, well wetted with salt water. The faradic current only is to be applied in this way.

Recent Subinvolution.—This subject has been treated of elsewhere (page 98), but it should be said, in this place, that subinvolution of the first or second month should be treated by the faradic or alternating current, preferably bipolar, though monopolar intra-uterine applications of either of these currents will check hemorrhage, hasten involution, and not only permit a prompt getting-up, but avert later consequences in the shape of invitations to catarrhal invasions that so often supervene on this condition.

CHAPTER XVIII.

MALIGNANT GROWTHS.

AMIDST the many uncertainties as to the true nature of the various forms of cancerous disease there are several facts that all authorities are agreed upon, chief of which are the strictly-localized character of the affections in their primary stages, and that the seat of malignancy must reside in the special forms of cells found in the several growths. A most important question yet undecided is the true relation of these cancer-cells to their environment. That this relation is that of an inoculable germ to a culture-medium would seem to be indicated by the facility with which autoinoculation may occur, either by grafts conveyed by the lymphatic or venous circulations or distributed to surrounding absorbent surfaces by the knife used to cut the tumor. Yet the persistent efforts of several observers have been but indifferently successful in the grafting of cancer from animal to animal. It is evident that the conditions of propagation are of a far more delicate nature than those attending the ordinary microbic affections, and that the discovery of these conditions will be associated with a greater advance in our knowledge of the nature of cancer than has occurred in modern times.

The important question of the prevention of cancerous affections, which are said to have doubled in frequency in the past forty years, must await this definite knowledge of their causation. Not so their treatment, for the twin facts of a primarily-local situation and delimitation of malignancy to the structure itself indicate that early and thorough removal or destruction of the malignant cells is the proper course.

While this early destruction of a local malignant growth is universally recognized as the only hope for its successful eradication, its accomplishment by the ordinary means now employed, the knife and caustics, is rendered difficult by the absence of a limiting membrane or capsule, there being no distinct line of demarkation between the morbid growth and surrounding tissues, the growth tending to

invade the latter in every direction by irregular prolongations, which are often extremely difficult to trace and remove at the operation. A means or agency which would not only destroy all easily-accessible cancer-cells, but also traverse selectively these prolongations with the same result, is necessarily a most important step in the curative therapeutics of this affection. Such a means the writer presented to the profession at the meeting of the American Medical Association at Philadelphia in 1897, in the massive dissemination of the nascent oxychlorides of mercury and zinc throughout the tumor and its ramifications.¹

The special merit of this method is that not only are the malignant cell-structures destroyed in all portions of the growth where they are evident to the senses, but the hidden ramifications are also sought out by a diffusing current carrying nascent chemicals of a lethal character, which traverse the cancer-ramifications as paths of least resistance, thus substituting a physical law for the unaided senses of the operator as a detector and destroyer of the more distant ramifications. In addition, it is the purpose of this method to arouse the defeated physiologic resistance of the surrounding tissues into renewed activity, that the errant cellular action may be again brought under the control of the trophic nervous system.

The treatment of cancer by electricity alone is by no means a new thing, instances of successful results having been published by many physicians during the last forty years, and an important paper contributed to the subject by Dr. Robert Newman, of New York, at the meeting of the American Electro-Therapeutic Association in 1891. That these reported results attracted but little attention was doubtless due to the fact that they all, with the exception of those of Dr. Newman, occurred in the dark ages of electricity, when it was practically impossible to duplicate the conditions under which the agent was used, it being impossible to measure it, and doubtless often impossible to generate it in sufficient dose except by accident.²

¹ See Medical Record, July 31, 1897.

² For an excellent bibliographic review of the treatment of cancer by electricity in the past see an article by Mrs. Edith Faithfull in the *Contemporary Magazine* (English) for March, 1892, the writer stating that, having been placed under this treatment after failure of the knife, she had searched out the literature of the subject. She has gathered a remarkable number of references to its successful use.

It is to Inglis-Parsons, of London, that we owe the revival of interest in this subject since the opening of the present age of electric power under control.¹ Rejecting simple electrolysis as a chief mode of action, he prefers sudden current-alternatives of high power (400 milliamperes), applied by means of needles which include both poles within the tumor, the "traumatic action produced by the sudden impact of a powerful alternating current through the tissues between the two points of insertion" being chiefly relied upon.

As this method is extremely painful by reason of the shocks given as well as the bulk of current, the patient is fully anesthetized. The following extract gives a full description of his method of treating malignant growths as adapted to the special variety mentioned:—

Inglis-Parsons's Method in Epithelioma of the Portio Vaginalis.²—"These cases, taken at an early stage, are very promising, because the disease, as a rule, has neither extended deeply nor invaded the lymphatic glands. If an operation is decided on, the patient should be kept in bed for a few days, and an antiseptic douche should be used until the vagina is aseptic. The patient is then placed on the operating-table, in the lithotomy position; ether is administered. The next step to be taken will depend on the size, extent, and characters of the growth. If, for instance, there is a large ulcer with a great deal of soft, breaking-down tissue, it is better, as a preliminary measure, to scrape this with a blunt curette, and apply strong perchloride of iron to check bleeding. In applying the curette no force should be used; only the friable material which comes away easily should be removed. One advantage of doing this is that the parts can be made thoroughly antiseptic: a consideration not to be lost sight of when we may require to puncture the cellular tissue around the uterus through the vaginal wall.

"In other cases, where the ulceration is slight and the tissues superficial, the curette is not required. Now, in the treatment of epithelioma by electricity it is necessary to rely upon the caustic action of the two poles, for the reason stated before, that this form of

¹"The Healing of Rodent Cancer by Electricity," by J. Inglis-Parsons. London, 1893: John Bale & Sons.

²The author's method as applied to this affection will be found on page 253.

growth has a higher electrical resistance than the healthy tissues.¹ Sims's speculum is passed into the vagina; the cervix is taken hold of by a strong pair of tenaculum forceps and pulled down as far as possible to the vaginal outlet by an assistant. A second assistant stands at the batteries, watches the galvanometer, increases the number of the cells in the circuit, and alternates the current by means of a commutator, according to the directions of the operator. Two needles at a time only are used. One of these should be run into the growth; the other, held in the operator's hand and having a sharp point, makes a trench into the healthy tissue all around the growth. The depth of this will depend on the case. Through this edge the needle should be pushed under the growth; a current of 400 milliamperes is left on for ten seconds, and then alternated by the assistant with the commutator for another ten seconds. The position of the needle should then be changed. In this manner the whole of the growth must be undermined, and when the operation is finished the whole of it should look bloodless and almost black. When the growth is extensive it may be necessary to do two operations. As a rule, I never go on for more than an hour at a time. For carcinoma of the cervix the same precautions must be observed to keep the patient aseptic. As the ulceration is generally more extensive in these cases, the use of the curette, for scraping away all of the dead tissues available, becomes more necessary. It must be done thoroughly, and, if there is a cauliflower excrescence, this must be removed. Hemorrhage can usually be checked by applying a pledget of cotton-wool

¹The electric resistance of cancer-tissue depends greatly upon its histologic arrangement. The greater the proportion of cells, the less the resistance, particularly if the cells be cylindric rather than the squamous variety; and, the greater the proportion of connective tissue, the less the resistance. In cauliflower excrescence and soft medullary tumors the cells are in excess and the resistance less than in normal tissue. In the squamous-celled variety, so-called "scirrhus," the resistance is likely to be much greater than normal, as stated by Dr. Parsons. It should be remembered, however, that even in scirrhus the resistance is greatest in the centre of the growth and least at the periphery, where we wish the electricity to be the most deadly. In any case the cellular parenchyma of a cancer will convey more current than the fibrous stroma, since it contains more water; hence a moderate current traversing a scirrhous formation may be lethal to the scanty parenchyma by reason of concentration.—G. B. M.

soaked in the strong solution of perchloride of iron. Bleeding vessels must be secured in the usual way.

"When the patient is in a fit condition and the vagina is clean and free from odor, a second operation may be done with electricity. The patient is placed in the lithotomy position and the batteries and assistants arranged as before. It is advisable for the anesthetist to keep his finger on the pulse and indicate to the operator any serious variation. A blunt electrode is now passed up to the fundus and a needle is passed through the vaginal wall into the cellular tissue surrounding the uterus. The current is then flashed through and alternated. It should be allowed to pass for three seconds at a time. After ten interruptions the position of the electrodes can be changed. The blunt electrode should, during half of the operation, be brought into contact with the ulcerated surface which has already been curetted. A second blunt electrode may be passed into the bladder¹ and the current sent through from uterus to bladder, and also to the rectum. The number of punctures required and the duration of the operation will depend entirely upon the extent of the disease, and must be left to the judgment of the operator. It is advisable to repeat the operation at the end of ten days or a fortnight. The patient can then be seen occasionally."²

While the method thus described by Dr. Parsons presents distinct advantages over the knife in certain cases, as claimed by him (and it should be stated that he does not claim that it is best in every case), it is to be observed that it fills but one of the requirements laid down at the beginning of this chapter, viz.: destruction of all apparent portions of the growth. The knife also does this probably as fully as this method. The method does not subject the apparently healthy tissues beyond the growth to an influence capable of destroying latent centres of regrowth, as may be done by a monopolar application and radial diffusion. Its principal advantage over the knife is bloodlessness.

It is a question, also, whether the mode by which it acts is not, after all, the electrolytic action of so large a current, even if the

¹ The author would hesitate to employ a current of this strength in these cavities unless they were themselves invaded by the growth.

² "International System of Electro-Therapeutics," page G-233. Philadelphia: The F. A. Davis Co.

duration be slight and the polarity subsequently reversed. The description of the condition of the growth after the operation is quite identical with the appearance of a similar growth after electrolytic destruction with the direct current. In ten seconds considerable electrolysis can be accomplished with 400 milliamperes, and if the electrolysis is then reversed the position of the ions will change place, but the electrolytically-killed tissue will, of course, not be revived. In an hour's work with a current of this strength so frequently reversed in a small space the included tissues are largely reduced to simple, chemic elements. It is, however, possible that the shock of sudden reversals of a ten-second current may have a lethal action of its own on cell-life.

Author's Method of Mercuric Cataphoresis as a Cure for Cancer.

—It was with the encouraging precedents of Dr. Inglis-Parsons's undoubted successes that the author began experimenting with carcinoma of the cervix uteri a number of years ago, and later with sarcoma of other portions of the body, and after several preliminary publications¹ he is now in a position to report results which, though few in number and not always successful, yet point to the germ of a truth of vast importance to the human race; for the history of the cases will show that the active principle of sarcoma and carcinoma can be killed by cataphorically impregnating the tumor with nascent oxychloride of mercury in sufficiently massive dose, while the cancer-holding tissues are not killed.

The destructive effects of caustics on these growths is well known,

¹ "Local Electrolysis and Zinc-Amalgam Cataphoresis in Malignant and Non-malignant Tumors," Medical News, March 9, 1895.

"The Treatment of Hemorrhagic Conditions of the Uterus by Zinc-Amalgam Cataphoresis," Journal of the American Medical Association, August 24, 1895.

"Zinc-Amalgam Cataphoresis in Muco-purulent Inflammations and Malignant Growths," Philadelphia Polyclinic, October 19, 1895.

"On a New Treatment of Sarcoma," American Medico-Surgical Bulletin, June 27, 1896.

"The Treatment of Cancer by a New Method, viz.: the Electrical Diffusion of Nascent Oxychlorides of Mercury and Zinc," Medical Record, July 31, 1897.

"On the Radical Cure of Malignant Disease by the Cataphoric Diffusion of Mercury from Gold Electrodes, with details of Late Improvements in the Author's Method," Philadelphia Medical Journal, March 19, 1898.

but they act only where placed, exactly as the knife does. By the cataphoric method a relatively-infinitesimal portion of the mercuric oxychloride acts lethally on the cancer-cells because of its nascent condition, and because it is carried by the current into the very cells themselves. But the most important point is that by the method we may cause the medicinally-laden current to seek out and follow the paths of proliferation of the growth by reason of its selection of paths of least resistance, and it is the failure to destroy these incipient proliferations that causes the frequent reappearances after attempts at extirpation with the knife. This selective tendency of the current is both absolute and relative, in the one sense being due to the physical fact that cancerous ramifications usually invite the passage of a greater current in its transit from the active pole placed within the growth to the distant indifferent pole by reason of a *less electric resistance*, due to its cellular structure; and, in the other sense, a selective action results from the *lessened physiologic resistance* of the cancer-tissue as compared with surrounding structures. Some of my cases have clearly proved that the cancer-cell has less physiologic resistance to this interstitial attack than normal tissue, for *it is found to lose its vitality at some distance from the electrode without being accompanied by necrosis of the healthy tissue*.

This diffusion of a metal from a corrodible electrode occurs only at the positive pole, as explained elsewhere (page 40); it is, therefore, necessary to connect the active electrode to this pole of the battery, and to furnish as large and perfect an indifferent electrode as can be placed elsewhere on the body. It was the oxychloride yielded from a zinc electrode coated with mercury which first attracted the author's attention to the possibilities of the cataphoric injection of lethal products into cancer-tissue. These experiments, which began in 1893, were, however, but partially successful, owing to the small dosage employed, and it has only been since May, 1897, and since the employment of complete anesthesia and massive doses, that the great value of the application has been demonstrated.

Coincident with the use of anesthesia for the purpose of an immediate penetration of all portions of the cancer was the discovery that mercury could be employed as the active agent by amalgamating a gold electrode with it, and that when mercury was so used it quickly disappeared into the tissues: a phenomenon not before observed. All that remained to be done after this discovery was to devise means to

keep up the supply of mercury at the active surface of the gold in order that a proper amount of the nascent salt might be disseminated through the tumor, for the merely-amalgamated surface became quickly bare under any considerable current. This was accomplished by having the instruments (Fig. 66) made hollow and perforated at the active extremities, in order that the mercury could be injected freely about the active surface before the current was turned on, a small glass syringe being used to inject the metal through a soft-rubber tube.

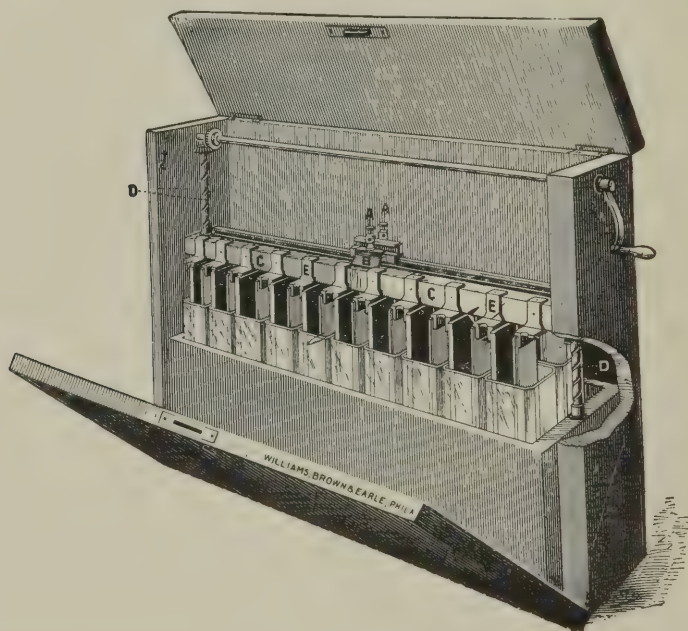


Fig. 65.—The Massey transportable galvanic battery, as made by Williams, Brown & Earle, Philadelphia. The special features of this battery are the large size of the cells and their ability to permanently resist acids, being made of glass; the special mechanism for instant removal, amalgamation, and replacement of the elements; and the mechanism which permits of lowering and raising the elements with ease or of leaving them in any position desired. At *A A* are the binding-posts for attachment of the cords, the posts having their polarity marked on them. These posts rest on a sliding volt- or cell- selector (*B*), which permits any number of cells to be selected, as in the old-fashioned batteries, making a convenient controller for very high currents. To the element bar (*C*) the element

Details of the Author's Major Method.—*Source of Current.*—

The street-mains of an Edison incandescent lighting current of 110 volts may be used, but the author's work has been done with two thirty-cell batteries of the acid-carbon variety coupled in series, giving a combined pressure of about 120 volts. This battery force is usually essential, as the available current required varies from 350 to 1200 milliampères or more. The batteries must be in the best condition, freshly cleaned, reamalgamated, and freshly charged. The ordinary portable galvanic batteries have too small a cell to maintain this current-strength with certainty, and I have, therefore, designed a transportable battery with larger cells and better mechanism (Fig. 65) two of which can be relied upon to give sufficient current during the time required. They are made by Williams, Brown & Earle, of Philadelphia. The two batteries are placed in series by connecting the negative pole of the first with the positive of the second, when the positive pole of the first and the negative pole of the second will be the poles of the combination. Cords from these are carried to the binding-posts of the switch-board.

Electrodes.—Considerable experimentation was required in devising the golden electrodes to be used in this electro-mercuric treatment of cancer. The earlier applications of mercuric cataphoresis were made with zinc electrodes heavily coated with mercury, but it was soon seen that the zinc surface became deeply eroded, and that a pure mercuric dissemination would require a more refractory surface for the electrode, and would probably produce quite different effects from that caused by the mixed chlorides. The only metal sufficiently resistant to the current that would combine with mercury was gold,

connectors (*E*) are attached by a special device, which permits any pair of elements to be instantly removed or replaced. The elements when in position are simultaneously raised and lowered by the worm (*D D*), which is operated by beveled cog-wheels actuated by a lever-handle. A few turns of the handle will immerse the elements to any extent desired, in which position they will remain, thus forming an additional means of controlling the output of the battery. This form of battery, transportable rather than portable, has been designed to furnish, without detrimental self-heating, the strong currents employed in the treatment of cancer, but is equally well adapted to ordinary medical work, the increased weight being offset by greater duration of the charge and of the zinc element. The cells should be emptied before being sent out, and refilled in the operating-room with electropoion fluid.

although it was soon observed that this metal would also be slightly eroded by a powerful current, resulting in the diffusion of a mercuric chloride slightly mixed with auric chloride; this mixture, unlike that of zinc and mercury, was not essentially cauterant, and therefore fulfilled the conditions frequently demanded of cell-destruction without necrosis of the tumor.

Eighteen-karat gold, in which the alloy should be silver, give the necessary rigidity, the alloy in the surface of the gold soon disappearing in the first use of the instrument. The shape given to the electrodes designed to pierce tumors is shown in Fig. 66, and the blunt, or bulbous, electrode for use in cavities in Fig. 67. After amalgamation the gold becomes brittle, so that it is necessary to construct the distal end, to which the conducting cord is attached, of some other metal not affected so easily. The larger electrode (1, Fig. 66) is finished with platinum for this reason and the small one with silver. (Platinum is totally unaffected by mercury, but silver will absorb it, though more slowly than gold.) These electrodes have been made for me with great care by Baernkopf & Co., 731 Sansom Street, Philadelphia.

Both electrodes are so constructed as to be capable of being heated to a red heat in the flame of a Bunsen burner or alcohol-lamp after use, and this should invariably be done, when all the mercury will be driven off in a green vapor, leaving the gold clean and safe from further action of the mercury, as well as safe from danger of being broken. The same care should be bestowed on the gold bulb and the metallic portion of the shank of the bulbous electrode. While thus getting rid of the remaining mercury that would otherwise render them brittle, this heating of the electrodes results in complete asepsis of the instruments preparatory to their future use.

When preparing for an application, the electrode or electrodes to be used should be amalgamated again, ample time being allowed to do this thoroughly. To make the mercury adhere to the gold a bit of absorbent cotton should be moistened with dilute sulphuric acid and the electrode rubbed on it and dipped in mercury alternately, until an abundance of the fluid metal adheres to all parts of the active surface. Should it be desirable to insulate the shank of the electrodes, this may be done for each application by fusing shellac upon it to the extent desired, but this shellac should be removed in the subsequent heating process, in order that all portions of the in-

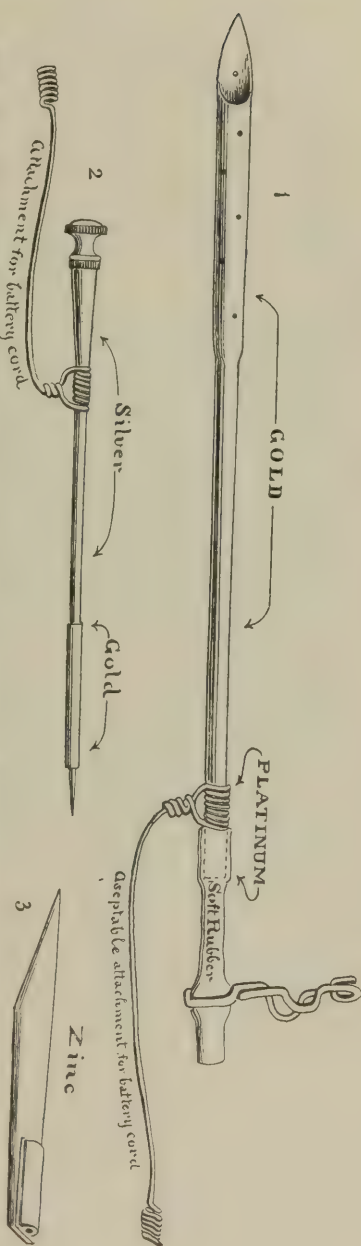


Fig. 66.—The author's gold and zinc puncture electrodes for the cataphoric treatment of cancer. (Reduced to $\frac{2}{3}$ natural size.) No. 1 is constructed of 18-karat gold throughout, except at the point where the wire and rubber attachments are made, where it is constructed of platinum tubing, since the gold would crumble under the wire attachment when impregnated with mercury. The special shape, somewhat similar to a pen and penholder, has been found to combine the qualities of greatest strength when weakened by mercury, with least requirements of gold and easy penetrativeness. Holes through which the mercury may pass have been made near the point, back of which the stem is contracted to a smaller calibre in order that it may be coated with shellac at will, previous to the application. No transverse joints are admissible in the construction of the gold portion of the instrument, as these will be eroded under action and will break the flow of mercury. The connection is best made by a piece of No. 22 bare copper wire,

twisted as shown, as this permits the whole instrument, except the rubber tubing, to be aseptized in the flame at the time of driving the mercury off after use. By having this copper wire about six inches long, that amount of conducting material is also aseptic, keeping the less-easily-aseptized cords farther from the wound. This instrument is intended for use in large external malignant growths, such as cancer of the breast, etc., but may be insulated for application within cavities.

No. 2 is intended for smaller growths, and is constructed of silver or platinum, except near the active end, where a heavy jacket of gold is attached. It has a steel trepan to insure sufficient rigidity for penetration; this should be removed after placement of the electrode, and a rubber tube slipped over the outer end of the electrode for the injection of the mercury.

No. 3 represents one of many forms of zinc electrodes for penetrative purposes.

strument be freed from the mercury before being put away. The steel trocar in the smaller electrodes should be removed for both heating and reamalgamation, and aseptized in some other way.

The Indifferent Pad.—On the operating-table a lead plate is laid, about 12 x 20 inches in size, to which is affixed a binding-post for attachment of the negative cord. Over this is laid a thick pad of some absorbent material well soaked with hot water. This pad should be thick enough to prevent local action, and should extend well over the edges of the lead plate.

Preliminary Details.—Before etherization is begun the batteries and switch-board, or, in the absence of the latter, a separate controller and meter, should be properly disposed and connected and the

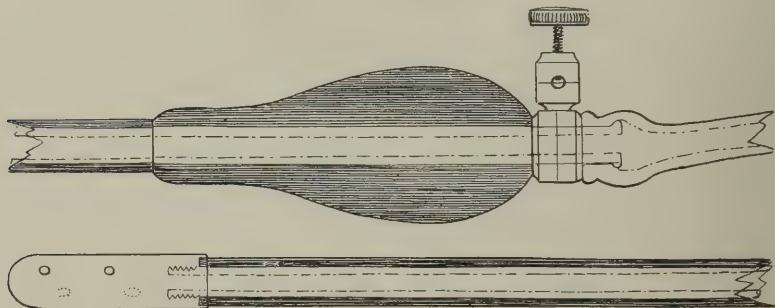


Fig. 67.—Hollow, bulbous electrode of gold, for dissemination of mercury in cavities.

perfection of circuit tested. Arranged on an aseptic tray on a convenient table there should be a bistoury for making incisions for the electrodes; the electrodes themselves, thoroughly and freshly amalgamated and with rubber tubes attached for injection of the mercury; and a small glass syringe filled with metallic mercury. An additional supply of mercury should be placed in a dish on the table.

Assistants.—Besides the etherizer, the operator will need an assistant to inject the mercury after the electrodes are inserted and another assistant to turn on the controller, the operator himself being sufficiently employed in the management of the electrodes and in noting the current-strength and effects.

The Application.—The patient having been etherized and placed

on the table, or etherized on the table itself (Fig. 68), the indifferent pad should be examined and pressed close to the body, the greater portion of it being behind the hips and against the thighs. No portion of the metal plate should touch the body. With a narrow bistoury a slit should be made in the tumor in an appropriate spot and an electrode thrust deeply into place, near, but not too close, to its base, for the principal action is downward. In hemorrhagic tumors the slight hemorrhage that this occasions may be avoided by insert-



Fig. 68.—Arrangement of apparatus and patient in the cataphoric treatment of cancer.

ing the electrodes as the negative pole by temporarily reversing the connections and turning on sufficient current for this purpose.

Having inserted the electrode or electrodes required and verified the polarity of the active electrodes as surely positive, the glass syringe should be inserted in the tubes of each electrode in turn and an abundance of mercury forced into them and into the tissues about them. The necessity for an excess lies in the rapid dissipation of the portion adhering to the gold under a strong current, and, unless an

abundance of the metal remains in electric contact previously to turning the current on, the gold will lose contact with the mercury near it, and a mere positive cauterization will result. The mercury is held within the electrode by the spring clip. Should the duration of the application be considerable, additional quantities of the mercury may be injected without interference with the current.

The Current-strength and Current-duration.—The strength of the current and its duration depend entirely on the extent of the growth. The author's applications under ether have thus far varied between 350 and 1200 milliampères, and in duration between fourteen minutes and half an hour. It is quite likely that both of these extremes can be wisely increased in large growths where immediate results are necessary, for it is evident that a sufficient quantity of mercury should be acted on and disseminated to produce a lethal density of the agent in all parts of the growth, no group of cells being permitted to escape. That this will require a time proportional to the distance of the remotest groups of cells from the nearest electrode is evident from the statements concerning the cataphoric speed of substances on page 46. *No increase of current will make up for a lack of penetration due to insufficient duration.*

It should be the aim of the operator to accomplish complete results at the first application, though a second application can be made a month later, if it is seen, during the healing process, that this aim has not been accomplished.

Immediate Results.—Within a few moments after an adequate current has been turned on the tumor will become somewhat blanched and shrunken, these appearances increasing during the application. About each electrode a grayish-white necrotic area will form, of limited extent, which will serve to maintain subsequent drainage. If there has been any odor due to previous necrosis or ulceration of the cancer, this will disappear during the application, and will not be likely to return if the application has been thorough.

The amount of pain suffered by the patient after emerging from the ether varies. If the tumor is large and previously painful, the latter will be lessened permanently by the application, though severe pain, which is readily controlled by morphine, is often felt for several days subsequently when the cataphoric action has been carried deeply into healthy tissue and the secondary reaction has been well established. This secondary reaction is a marked feature after applica-

tions to organs that are only partially infected by the cancer. It is doubtless due to an irritative reaction of the surrounding normal tissue, and thus assists in delimiting further cancerous growth at the periphery of the tumor. The reaction and accompanying pain cease about the third day, when the patient is free from pain and will remain so.

After-treatment.—The tumor is dressed with dry acetanilid powder and absorbent cotton daily, after being cleansed from the gray discharges and the excess of mercury which pour out, and the wounds become clean and ready to heal by granulation in from twelve days to three weeks. During this process there is but little tenderness and no unpleasant odor.

Details of the Author's Minor Method.—Most of the earlier cases mentioned below were treated by the milder method, in which anesthesia was not used and amalgamated-zinc electrodes were employed. The action of the combined zinc-mercuric oxychlorides formed from such electrodes is totally different from that of pure mercuric cathaphoresis, a whitish eschar being quickly formed about each electrode, which becomes an extensive slough if a strong current is used. This slough is not entirely inodorous, but has a special value when quick destruction of an hemorrhagic sarcoma of large size is desired, when the zinc may be used in the major method without causing the loss of a drop of blood. The currents usually tolerated without ether rarely exceed 50 to 80 milliampères, according to the location of the growth, though I have used 300, the details of the application being otherwise the same as in the major method. It should be repeated daily or as often as possible until a cure is effected.

The minor method, with either zinc or gold electrodes, is suitable for small local growths and in cavities in which the assistance of direct vision is lacking, but it is always inferior to a thorough application, and should never be employed without a reasonable prospect of a speedy mastering of the growth.

Such is a brief outline of the methods and their technical details, but it should be understood that these details are subject to change, in accordance with the individual characters of the growth and the part of the body in which it is situated. The underlying principle that constitutes the novelty of the method is that there is a virtue in the electric diffusion of nascent chemicals throughout a malignant growth which, when of sufficient density per area, will cause an in-

terstitial death and ultimate absorption of the malignant cells at a distance from the electrode, without destroying the connective tissue surrounding them, and that this intracellular lethal action is independent of and additional to the ordinary destructive action of a strong current in the immediate neighborhood of the electrodes.

Illustrative Cases.—The discovery of this peculiar action of nascent oxychloride of mercury was made while the author was conducting the treatment of a case of inoperable carcinoma of the groin in August, 1893, by means of a carbon electrode used as the positive pole, which had been the method employed in a number of cases of carcinoma of the cervix uteri with but indifferent results. The rapid disintegration of the surface of the carbon-ball instrument employed in this particular case under the heavy currents used suggested the value of zinc cataphoresis, then already in use in endometritis and other benign conditions, and the mercury was first applied to the surface of the zinc to keep the latter from adhering to the surface of the wound as it would otherwise do. But there was an improvement noted in the outer edge of the growth at some distance from the electrode by the next day, and this, coupled with the facts that the wound became rapidly aseptic and that the use of 100 milliamperes for some minutes lessened the amount of mercury adhering to the electrode, showed that the mercury itself was diffused in greatest amount, and suggested the immense advantage that might accrue from the use of such an agent. This case, in which the carcinoma was about three inches in diameter and adherent to the great vessels of the thigh, became much better under prolonged employment of the milder method, nearly the whole of the diseased area filling in with healthy granulations and the gentleman regaining the power to walk: but it was unfortunately impossible to eradicate the cancerous infiltration of the femoral artery and vein, and the termination was ultimately fatal.

This case, together with the following seven cases, taken from the paper read before the Section of Practice of Medicine of the American Medical Association in June, 1897, represent the author's experience in the first series of cases to that date, though only a portion of them occurred in the practice of gynecology.

Case 2. The second case, and the first apparently complete success, was a recurrent sarcoma of the palate, which had been partially destroyed by the writer by ordinary electrolysis in 1893. This man,

W. H. L., aged 39, had been sent to me by Drs. Hemminger and Bixler, of Carlisle, Pa., with a sarcoma of the left palatal arch fully the size of a goose-egg, which he had declined to have removed at the University Hospital. Nearly complete destruction with platinum needles gave him comfort for a year, when it was noticed that lumps were redeveloping in the scar. He was at this time (in 1894) placed on the mild zinc-mercury method, which was kept up daily for six weeks, resulting, after some subsequent treatment, in a disappearance of the growth.

Case 3. The third case treated by the method was a farmer from Salem County, N. J., aged 55, with an immense epithelial cancer of the face, extending from the external angle of the right eye to the under border of the lower jaw, the functions of the corresponding eye and ear being abolished and the right ramus of the lower jaw destroyed. He was admitted to the Howard Hospital and an effort was made to change the character of this immense surface by the milder method described, the current not exceeding 100 milliamperes, and the treatment was kept up for some months. As no permanent change of sufficient magnitude was produced, he was finally sent home in a slightly improved condition. I have learned since that he died about a year later.

Case 4. Mrs.—, aged 50, was sent to the author by Dr. Saylor-Brown, of Williamsport, Pa., October 8, 1895, in a condition of profound anemia and cachexia from an upper-rectal ulceration of twelve years' standing. She suffered from considerable pain in the left groin and had from twenty to twenty-five black, foul-smelling stools per day. Local treatment was undertaken with a new, hollow, rectal electrode similar to the gold electrode shown in Fig. 66, with an olive-shaped active surface consisting of mercurialized zinc, and so connected with a syringe that its insertion was facilitated by a cushion of albolene dilating the rectum ahead of the electrode bulb. A constriction was encountered about six inches from the anus which was extremely sensitive. From 40 to 100 milliamperes were employed with mercuric cataphoresis. After several applications a piece of tumor-tissue came away about the size of the last joint of the little finger and was sent to Dr. Alfred Stengel for microscopic examination, who pronounced it carcinoma. A large number of such pieces came away subsequently, and after a prolonged treatment she was sent home considerably improved in weight and general health, with

the greater portion of the ulceration healed over, and having not more than two or three stools per day.

Case 5. The fifth case, Mrs.—, aged 36, of Muncie, Ind., came under my care March 3, 1896, with a recurrent sarcoma of the left pectoral muscles about 3 x 4 inches in superficial extent and apparently pressing upon the brachial plexus and the blood-vessels of the arm, for the left arm was swelled and the seat of constant pain. Less than two years before, in July, 1894, the left breast had been removed by a distinguished surgeon in the West. This case would have been an excellent one for the stronger method described, which had not yet been developed. An opening was made in the skin and a zinc-mercury electrode inserted daily with about 100 milliamperes, under cocaine, cataphorically applied. After a number of applications the swelling and pain in the arm disappeared, and later a piece of the sarcomatous tissue came away about $2\frac{1}{2}$ x 1 inches in size and resembling a piece of sponge filled with cheesy material, and the wound was in a fair way to heal. Unfortunately, acute mania developed at this time, the patient's mental condition having been suspiciously exalted for some time before admission, compelling her husband to take her home, where the acute mental affection terminated fatally.

Case 6. Mrs. A., aged 51, of Salem, N. J., came under my care in June, 1896, suffering apparently from general prostration. In searching for the cause I found a suspicious ulceration of the os uteri, the cervix being enlarged, hard, and very irregular in outline and badly ulcerated, exuding considerable discharge characteristic of carcinoma. Suspecting malignancy, I at once conferred with her husband and suggested the new treatment. He, however, decided to take her elsewhere for additional counsel. A week later he brought his wife back to me, saying that he had taken her to Professor Parvin, who concurred in the diagnosis of carcinoma and advised curettement, to be followed later, possibly, by removal of the uterus. Being still dissatisfied, the patient was taken to a homeopathic physician, who also pronounced the affection carcinoma, but proposed that the patient come under his care for electric treatment. This latter suggestion caused the gentleman to bring his wife back to me, and she was placed on mild daily applications of the mercurial cataphoresis with currents varying from 50 to 100 milliamperes applied by the smaller-size zinc electrode of the set shown in Fig. 26, with the shank

curved somewhat. The duration of each application was under ten minutes. This active treatment was continued for about six weeks, the local conditions improving rapidly, when she was sent home to return for an application three times a month. This was changed later to once a month.

The uterus is now normal (February, 1898), the diseased area being completely healed and general health restored. By appointment she was taken to Professor Parvin to verify her restoration to health on the 28th of May, 1897.

Case 7. Mrs. P., aged 70, is now under treatment at the dispensary of the Howard Hospital for carcinoma of the cervix of the scirrhus variety. The cervix had practically disappeared by erosion when the treatment was begun in the fall of 1896 and the patient suffered from frequent hemorrhages, continuous watery discharge, and hypogastric pain. The uterus was fixed and the vagina atrophied, shortened, and surrounded by unyielding walls. Under mild intra-cervical applications with a small zinc-mercury electrode the hemorrhages ceased, pain became infrequent, the discharge lost its offensive odor and nearly ceased, and a cachectic condition has been replaced by relative health. The rigidity of the shortened and narrowed vagina continues, but the whole mass can now be slightly moved. The patient is still under treatment.

Case 8. Mrs. E. M., aged 47, came under my care at the Howard Hospital in the autumn of 1896, and was the first case operated upon by the stronger method. A tumor existed in the scar-tissue and skin at the site of the right breast, the breast having been removed by a surgeon at the Hospital of the University of Pennsylvania about three years previously for carcinoma. The tumor was about the size of a half of an orange. The glands of the axilla were normal and had not been removed at the operation.

An attempt was at first made to arrest the growth by the milder method, but, this appearing too slow, the tumor was operated upon by zinc-mercuric cataphoresis with 1000 milliampères at the hospital on May 3, 1897, in the presence of Drs. A. E. Roussel, E. P. Bernardy, and the hospital residents. The tumor at this time had increased considerably since first seen, measuring $3\frac{1}{2} \times 3\frac{3}{4}$ inches. In this application, the negative electrode, a moistened disk, was also placed on the tumor, making the application bipolar.

An immediate blanching and shrinkage of the growth was noted,

with the production of small necroses at the site of each electrode and in the centre. At the end of thirteen minutes the current was turned off, the electrodes withdrawn, a dry dressing applied with iodoform dusted over the surface, and the patient put to bed. The sloughs separated painlessly in ten days, leaving an apparently healthy granulating surface, but before this time the interesting fact was noted that the tissues between the electrodes that had been elevated, hard, vascular, and purplish with malignancy, but had not become necrosed, were now level with the surrounding surface, soft, and possessed of a healthy pink color; showing that *an influence or substance passed between the electrodes capable of destroying the cancer-cells that was unable to devitalize the normal tissues containing them.* All evidence of malignancy had disappeared except at one spot, about the size of a marble, that was unquestionably abnormal, and another spot that appeared doubtful.

At the end of a month these two remaining spots were subjected to a second application under ether, this time strictly monopolar, with the negative pads on the abdomen and back. Five hundred milliamperes were applied, divided between five zinc-mercury lancet electrodes, in the presence of a number of physicians in attendance on the meeting of the Americal Medical Association then in session in Philadelphia. The cup-shaped depressions that resulted when these necroses separated seemed to include all that had been malignant, the surrounding flesh being soft and normal; but, while they were filling with healthy granulations, internal metastasis, of probably earlier formation, carried the patient off.

The methods here described have since been applied successfully to the following cases:—

W. O., aged 39, an employee of a sugar-refinery in Philadelphia, applied for treatment late in October, 1897, suffering from a sarcoma of the superior maxilla, which caused protrusion of that side of the face and projected into the mouth, having caused four teeth to painlessly fall out. The case had been seen by Dr. Hearn and by a surgeon at the Medico-Chirurgical Hospital, both of whom diagnosed sarcoma, and advised removal of the whole upper jaw. On October 27, 1897, he was placed under ether, and 300 milliamperes applied for fifteen minutes, with mercury abundantly supplied from a gold electrode. I was kindly assisted by Dr. Bernardy in this case, whose interest in the subject has been most unselfish. The result of this

application was less perfect than it would have been with a longer duration, and it was found that but one-half of the tumor was favorably affected. Office applications were begun four days later with an amalgamated-zinc electrode, which could be painlessly thrust into the tumor without any form of anesthesia, though currents of more than 40 milliampères were unbearable. As these latter applications seemed to have an adequate effect on the remaining portion of the tumor, they were continued thrice weekly for two months, during which time the sarcomatous tissue showed a decrease that was perceptible daily, both in loss of substance and encroachment of the surrounding normal tissue. At the end of two months all malignant tissue had disappeared, leaving a cavity that was quite narrow, considering the size of the growth, and which has since grown progressively smaller. A cachectic color that the patient presented when first seen has been replaced by the ruddy hue of health.

A lady of 66, who had had the right breast removed in January, 1897, presented evidence of recurrence in the line of a lymphatic vessel in October of the same year. On the 11th of December she was placed under ether, and three small amalgamated-gold electrodes inserted, through which mercury was injected and cataphorically diffused by 500 milliampères for fifteen minutes, with the kind assistance of her physician, Dr. Ida E. Richardson and Dr. W. C. Thompson. At the end of this time all the malignant nodules were softened, and a grayish-white spot appeared at the entrance of each electrode. The after-pain was considerable and lasted about two days, but there was no further pain during the period of healing, and there is now a normal cicatrix without evidence of remaining infection.

The most recent case was that of a woman of 56 who presented herself with an ulcerated carcinoma of the sublingual salivary gland. The tumor was growing rapidly and gave rise to excruciating pain, the progressing involvement of the tongue preventing the swallowing of solids. She was placed under ether on December 28, 1897, with the kind assistance of Dr. S. J. Gittelson, and 400 milliampères were employed with a gold electrode and mercury for half an hour. A horrible odor that had been emitted from the growth disappeared during the operation and never returned, in spite of the fact that the whitish slough produced did not separate entirely until the expiration of three weeks. The edges of the excavation cicatrized shortly afterward, and she is now well in every respect. The intense radiating

pain from which she suffered disappeared about four hours after the application and never returned.

Corroboration of these results has been afforded by the independently conducted observations of Dr. J. McFadden Gaston, of Atlanta, Ga., who reported a successful case of sarcoma somewhat similarly treated at the meeting of the American Surgical Association at Washington in May, 1897.

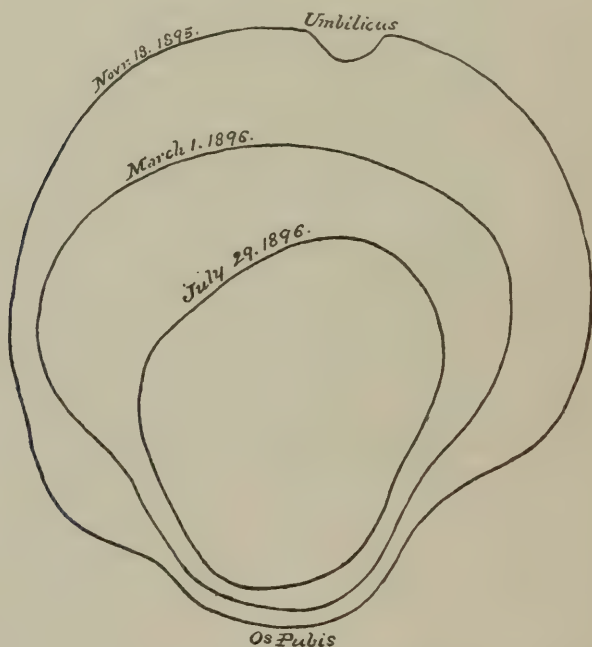
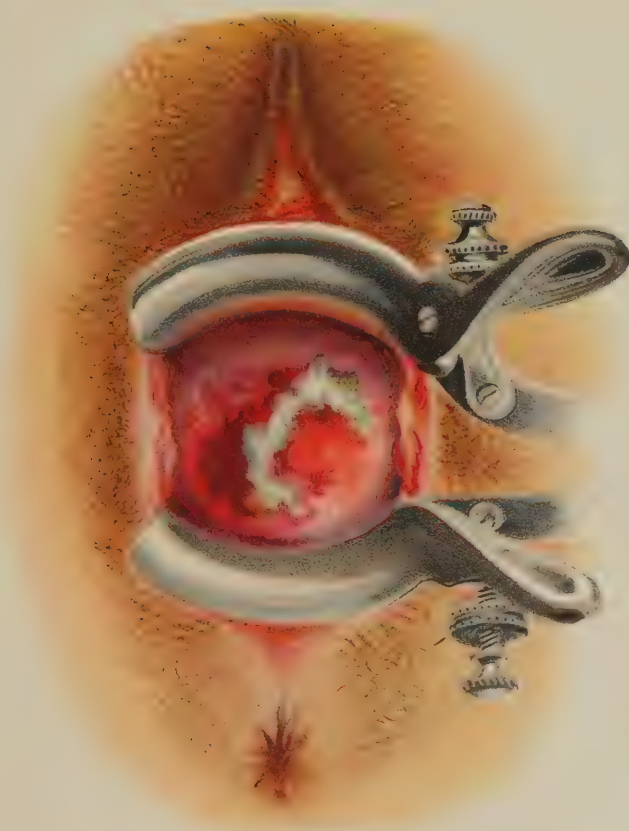


Fig. 69.—Outlines of circumference of sarcoma in Dr. McFadden Gaston's case.

With Dr. Gaston's kind permission I give the details of this case from his paper¹ in an abbreviated form. A boy of 12 presented a sarcoma in the hypogastric region of the size represented in the outer line of Fig. 69. Dr. J. B. S. Holmes, of Atlanta, made an exploratory incision, but found that the adhesions to the surround-

¹ Annals of Surgery, August, 1897.

PLATE XXI.



Carcinoma of the Cervix Uteri.

ing tissues were too great to permit of its removal. He was afterward seen by Dr. Hunter McGuire, of Richmond, who had a specimen removed and examined microscopically by Dr. M. D. Hoge, Jr., the latter pronouncing it a small, round-celled sarcoma. A radical operation was again declined. He was turned over to Dr. Gaston on November 16, 1895, who had not seen my publications on the subject at this time. Dr. Gaston at first used simple electro-puncture with positive needles around the base of the growth with a negative sponge electrode on the opposite margin. This was repeated on alternate days, but was later changed to the cataphoric administration of Donovan's solution,—the double chloride of arsenic and mercury,—the solution being placed on the positive sponge electrode and the needles being now negative. The absence of a milliampèremeter rendered the exact dosage uncertain, but dependence was placed on the local effect at the negative needles in increasing or decreasing the number of cells used as the cells varied in freshness of charge. Minute vesications alternating with pits were noted where the solution was applied and the usual evolution of hydrogen at the negative needles.

The progressive shrinkage is best realized by a reference to the figure, which is copied from Dr. Gaston's paper. He reports the patient entirely cured and well on May 31, 1897.

It should be added that Donovan's solution was given with other alternatives by mouth during the cataphoric treatment.

Technique of the Author's Method for Carcinoma of the Portio Vaginalis.—In my own method for the treatment of carcinoma of the cervix uteri a bulbous electrode of zinc, freshly amalgamated with mercury, of a size nearly filling the ulcerated cavity if small, is employed as a monopolar positive pole, the negative pole being two pads of suitable material covering the abdomen and back and both connected with the negative binding-post. The pads being in place, the patient lying in the dorsal position on the dorsal pad, the active pole is passed into position without other preparation of the patient than a simple daily antiseptic douche, for the method is itself powerfully antiseptic in effects. Preparatory curettement is very rarely performed except to remove manifestly necrotic shreds or masses, as it is unnecessary with the method and wasteful of blood and strength. The zinc bulb may be about two centimetres long and of a size to fit the cavity, all portions not touching the diseased area being freshly covered with fused hard rubber or shellac. If no cavity exists, as

in cauliflower excrescence, the most prominent portion of the tumor is to be destroyed by needles and simple bipolar electrolysis, for which two needles, the positive of platinum (or of zinc), are inserted into it. For a case of this nature the author devised the double bipolar instrument (Fig. 70), the two prongs per pole increasing the current by lessening the local resistance and insuring more rapid progress.

In all cases the monopolar zinc-amalgam applications are finally relied upon to complete the destruction of the cancerous margins and prolongations by repeated applications, extending over months if necessary, until the physiologic activity of the surrounding tissues is regained, and healthy granulation tissue replaces the morbid growth. The current-strength required varies from 50 to 200 milliampères, the insensitive nature of the uterus frequently permitting the latter strength to be attained without anesthesia. The duration



Fig. 70.—Double, bipolar instrument for electrolytic destruction within a cavity.

of the applications, which should be daily or triweekly, may vary from ten minutes to a half-hour, every consideration uniting in urging a rapid prosecution of the work.¹

When observed in a superficial carcinoma the immediate result of the application indicates a lessened hyperemia of the growth; a light-gray pellicle forms about the spot touched by the electrode, which comes away at the end of a few days, leaving the superficies of the growth somewhat shrunken. Under daily repetition of the process the cavity formed by the destruction of tissue becomes larger, but the reduction in the size of the growth is greater than would merely correspond with this destruction of tumor-substance, for the periphery will be found to be shrinking, the soft, normal tissue encroaching on the indurated edges. The applications must be con-

¹ I am now testing the advisability of employing ferric cataphoresis from iron electrodes, with the strong currents mentioned, in prolonged treatment.

tinued until the cavity is surrounded only by normal edges of but-slightly-indurated tissue, the determination of the point when the margins are found to be healthy being a matter of delicate judgment.

The cavity and the sanious discharges issuing from it during active treatment are nearly aseptic and odorless by reason of the antiseptic character of the nascent oxychlorides of zinc and mercury which have united with the superficial necrosed tissue; but antiseptic douches should be directed as an assistant in maintaining an odorless condition. Healing is to be prevented by frequent treatments until the physician is assured that the last vestige of lowly-organized cells has been destroyed and the normal trophic condition of the part restored.

This method is, of course, only applicable in strictly local carcinoma or sarcoma, extension to other portions of the body by means of lymphatics or veins rendering it a palliative only. Since when employed in any case it quickly lessens pain and promptly checks hemorrhage, its value as a palliative in incurable cases is nevertheless evident. Where the strictly local tumor is of large size and capable of being removed by the knife, it may be better to do so, and reserve this method for subsequent employment on the first reappearance of the growth in the cicatrix of the operation.

CHAPTER XIX.

BENIGN TUMORS OF THE BREAST.

THE mammary organs of women are subject to inflammatory indurations and adenomatous growths that simulate malignant tumors and often cause grave anxiety. A presumptive diagnosis of benignity is, however, often possible by a careful consideration of the symptoms, among those favorable to benignity being the youth of the patient, distinct evidences of inflammatory reaction, tenderness, slow growth, and non-adherence to the overlying skin. What might be termed a chronic lobular mastitis is probably the most painful form of tumor of the breast, presenting a nodule from the size of a hazelnut to that of a considerable portion of the gland, which is tender to the touch and the seat of a constant ache. Such tumors are most frequently found in young women, both married and single, and are often in close sympathetic relation with disordered menstruation or even ovarian congestion.

These painful inflammatory indurations are particularly amenable to external galvanic and faradic applications, particularly the former, the tenderness and unpleasant sensations yielding to a few applications and complete resolution ultimately occurring. The necessity for prompt treatment is accentuated by the possibility of the inflammatory condition proving a favorable seat and stimulus for the development of a previously existing malignant matrix.

The application is made with the patient reclining upon a dorsal pad of large size, the active pad, which is preferably negative and of a size equal to the induration, being pressed over the latter. This pad should be very moist and well soaped, and may be slowly rotated to lessen the action on the skin, the latter being kept in good condition for painless transmission of effective currents by being bathed daily with alcohol. Gentle massage in the direction of the lacteal ducts will assist the treatment.

Skene, in a work which deserves to be regarded as a pioneer treatise on the science of medical gynecology as contrasted with the

merely surgical treatises that have preceded it, describes a probably similar condition under the name of "areolar hyperplasia of the mammary glands."¹ With the exception of the first case, in which the breast was removed, some twenty-three instances had been observed by him, and all recovered under medical treatment without resort to surgery. How many of these cases would have preserved their breasts in less conservative hands? In all such cases the suspicion of malignancy, either present or prospective, would have been sufficient to warrant ablation at the hands of surgical enthusiasts, and an inflation of the statistics of non-recurrent malignancy would have surely resulted. These cases are, of course, not tumors in the pathologic sense.

The most common benign tumor of the breast is the adenoma, which is usually found as a small, hard lump from the size of a pea to that of a walnut. They may be multiple, and differ from both chronic lobular mastitis and malignant tumors by having a limiting membrane and being movable. They are apt to be more tender than a malignant tumor.

Such a tumor is easily removed by a surgical operation for enucleation, leaving the breast largely intact and without risk of recurrence; yet if the patient is averse to this there are two electric procedures available: either simple percutaneous galvanic applications or percutaneous iodine cataphoresis (by which the growth is arrested by stimulating the physiologic resistance of the surrounding tissues, removing pain, and lessening the growth) or by puncture and simple negative electrolysis.

¹"Medical Gynecology: a Treatise on the Diseases of Women from the Stand-point of the Physician," by A. J. C. Skene, M.D., page 355. D. Appleton & Co.

CHAPTER XX.

DISEASES OF THE URETHRA, BLADDER, RECTUM, AND SIGMOID FLEXURE.

DISEASES OF THE URETHRA AND BLADDER.

Caruncle.—This little tumor of the urethral orifice, which often gives pain and discomfort out of all proportion to its size, may be eradicated by several electric methods, after it has been temporarily anesthetized by the cataphoric application of a cocaine solution. The cocaine should be applied on a cotton pledget saturated with the solution and held on the part by a carbon or platinum electrode, positive, with 5 to 15 milliampères for some minutes, the negative indifferent pad being on the abdomen. If the growth is pedunculated the galvano-cautery loop may then be passed over it and the heat turned on as it is tightened. A sessile growth is best destroyed by negative puncture, followed, at the same sitting, by a small positive zinc-amalgam electrode pressed into the opening thus made; 10 to 15 milliampères will be sufficient.

Stricture or Ulcerations of the Urethra.—The treatment of strictures or ulcerations of the female urethra is as successfully accomplished as in the male and much more readily managed. The negative pole is, of course, necessarily the active one, as we wish a relaxing and softening effect, the electrode being the same as employed in the anterior urethra in males, having straight shanks with bulbs of different sizes. When not provided with these the physician may use the long-shanked zinc-amalgam electrodes designed for intra-uterine applications (Fig. 26) the smallest size being usually appropriate. When the latter are used they are best lubricated by mercury, but not for cataphoresis, since the negative pole is imperatively necessary for dilatation, and, like all other electrodes to be inserted within the urethra, should be scrupulously cleaned, preferably fire-cleansed, before insertion. Five to 8 milliampères is a sufficient current-strength, the current being turned on when the stricture is reached,

the operator gently pressing the instrument forward until it passes the contracted portion, then re-engaging it from behind. The procedure should be repeated every three or four days until a cure is accomplished.

Ulcerations of the urethra are best treated (as ulcerations elsewhere) by positive zinc-amalgam cataphoresis, very small currents of 3 or 4 milliamperes being sufficient.

Neuroses of the Urethra and Vulva.—Incontinence of urine in the adult may be corrected by a urethro-abdominal or urethro-sacral application of the primary faradic current, turned on in the swelling method for two to five minutes daily or every other day. In young girls or children the same results can be attained usually by external pubo-sacral applications of the same current with ordinary disk electrodes.

The treatment of painful or pruriginous affections of the vulva, urethra, or bladder—such as *pruritus vulvæ*, *vaginismus*, etc.—is by no means so simple, though often yielding the best results. We must here search for an organic or constitutional basis for the symptoms, such as erosions, lithemia, toxemia, or kidney disease, to be corrected simultaneously with the appropriate local application. It needs scarcely to be said that we employ the high-tension faradic current for a mere neurosis, having in view its anesthetic effect. If this be ineffective a weak solution of cocaine may be cataphorically driven in from a covered carbon electrode by a few milliamperes, the active electrode being positive.

For neuralgia of any portion of the pelvis a vaginal bipolar faradic current is usually effective with the high-tension coil.

Atony of the Bladder.—Contractile and tonic effects may be readily produced in the functionally weakened bladder by including the organ between the poles of a vagino-abdominal application of either current. A quickened micturition is, in fact, frequently noticed by patients undergoing this method for other purposes. In the paralysis from long distension, as in cases of chronic cystitis, particularly when fatty degeneration of the muscular coats of the organ is suspected, intravesical applications of the primary faradic current should be made, and, if vesical irrigation of antiseptic fluids be practiced, the current should be applied simultaneously by the swelling method while the bladder is ejecting the liquid. This may be done by attaching a twisted-wire socket for connection with the battery

to an ordinary silver catheter, insulating all but the tip with fused shellac, and employing it as an electrode. While the liquid is regurgitating the current will increase its force perceptibly, thus causing contraction of the bladder under the most favorable conditions. The irrigation is the only element of this application requiring special discrimination as to frequency, or producing possible reactions from overuse.

Cystoscopy.—In order that this subject may receive the most thorough and practical discussion, the author has requested Dr. Harris A. Slocum, Professor of Gynecology at the Philadelphia Polyclinic, to prepare a statement which will include the fruits of his wide experience in the examination of the bladder in women:—

Gynecologists have, for some time, recognized the close symptomatic relation of diseases of the uterus and its appendages with those of the bladder and such parts of the ureter and urethra as are in close proximity to it. This is probably due to the fact that the viscera of the pelvic cavity are supplied by the hypogastric plexus of the sympathetic, situated in front of the promontory of the sacrum, between the two common iliac arteries.

It may be noticed that the three principal pelvic organs in the female have a similar nerve-supply. The upper portions of the bladder, uterus, and rectum receive a nearly pure sympathetic distribution from the ovarian and inferior hypogastric plexuses of the sympathetic.

Their movements are unconsciously performed and entirely removed from the domination of the will, permitting, in the bladder and rectum, automatic adaptation to varying amount of contents, their retention during sleep, etc.; in a measure, this view also applies to the uterus when that organ is engaged in gestation, the sole object of its existence.

The outlets of these organs have a large proportion of insulated, spinal nerve-fibres. The sphincter ani receives filaments from the hemorrhoidal branch of the fourth sacral, the bladder and urethra being supplied from the third and fourth sacral, and the cervix the same. These introduce the elements of control or inhibition to the exit of each excretory organ (parturition is a modified excretion), more marked in the bladder and rectum, while evidently not at all volitional in the cervix.

The inhibitory function of the spinal element in the uterus is exerted, as before indicated, in the resistance offered by the cervix to

the rhythmic contractions of the uterine muscle during gestation, and is probably the chief reason for their presence in that part of the organ.

It is the intimate relation of the nervous and vascular supply of the pelvic tissues that contributes mainly to their close symptomatic relationship; the rectum, as well as the bladder, frequently requiring investigation in seeking the cause for symptoms apparently uterine.

The purpose of this contribution is to give a brief description of the ordinary methods of examining the bladder as applied to office practice, and will not deal with diagnosis or treatment.

Two methods of investigation are available: the indirect and the direct. In the former the view of the bladder is obtained through Nitze and Leiter's cystoscope, which consists of an angled tube resembling a urethral sound, about twenty-one millimetres in circumference. The tip of the instrument contains a tiny electric light behind a window of quartz. At the recedent angle within the tube is a prism so placed that the rays received from the bladder-wall are reflected through a telescope to the eye of the examiner. After connecting the rheophores, contact is made and broken by means of a milled screw placed conveniently to the forefinger.

Several modifications of this instrument have been devised, among which may be mentioned that of Skeene's, in which a ureteral catheter may be used and the ureters catheterized while under inspection.

In examining the bladder by this method, with the patient in the dorsal position, its interior is cleansed of mucus, pus, or blood if present, and filled with a warm, weak boric-acid solution, using a four-ounce glass or hard-rubber funnel, two feet of rubber tubing connected by a glass tube two inches in length with the catheter to be used. From four to eight ounces are necessary, according to the capacity of the bladder.

It requires a certain amount of experience with this instrument to obtain a correct impression of what is seen. The appearance of the area inspected varies with the distance of the prism from the bladder-wall. At 5 millimetres it is magnified to nearly twice the normal size; at 20 millimetres it is less than normal, while at 15 millimetres the view obtained about represents the true size of lesions as they exist. This distance is approximately secured by allowing the tip to touch the bladder-wall, and then withdrawing just suf-

ficiently to clear it. Contact between instrument and bladder should otherwise be avoided, as the heat generated after three to five minutes' use is sufficient to burn painfully, and might give rise to a cystitis that had not previously existed.

Rather than continue a long, uninterrupted examination, it is far safer to shut off the current for half a minute after three to five minutes' use, and allow the instrument to cool.

The second, or direct, method—described by Pawlik and Kelly—is far more satisfactory in examining the bladder in the female. The speculum is a straight, metallic tube nearly 10 centimetres in length, made in sizes of from 5 millimetres to 21 millimetres in diameter,

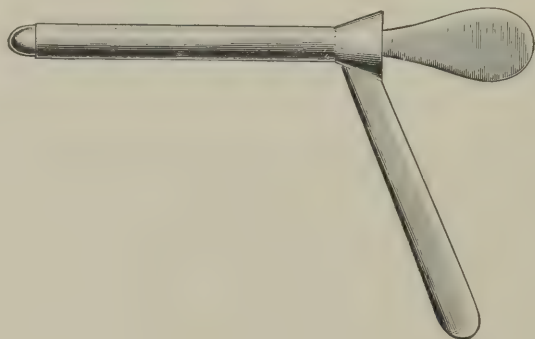


Fig. 71.—Cystoscope of J. Howard Kelly.

with a flaring proximal extremity, a handle placed at an obtuse angle, and an obturator, snugly fitted, to facilitate introduction.

When necessary, the urethra is dilated with Kelly's steel urethral dilators or his calibrator: a spherically-handled metallic cone 7.7 centimetres in length, 4 millimetres in diameter near the apex and 16 millimetres at the base, and graduated at each 2-millimetre increase in diameter. For office use or ordinary examination the 9-millimetre and 10-millimetre sizes are sufficient. The bladder-wall is easily examined through them, and they rarely require a preliminary dilatation.

Other instruments required are: one or two urethral catheters, an aluminium applicator, and an appliance for removing accumulating urine.

One of three positions may be chosen in which to place the

patient: Sims's position; the dorsal, with extreme elevation of the hips, and flexion of thighs and legs; and the knee-chest position. The latter is generally to be preferred; it is quickly attained and permits the maximum of ballooning.

Corsets, bands, and all sources of constriction must be loosened, and the patient instructed to breathe freely and gently, not forcing the air from the lungs.

The bladder should be thoroughly emptied before introducing the speculum, and voluntary voiding generally clears it of all fluid.

After having observed the preliminary instructions regarding the clothing, the light from the head-mirror is thrown upon the urethral opening, and the speculum, warmed and oiled, is gently inserted in the meatus. Bear in mind the slight curve to the urethra, and begin the operation by having the handle slightly depressed and the beak pointing a degree upward. When it has penetrated for about an inch

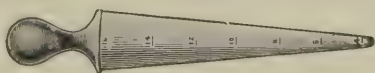


Fig. 72.—Urethral calibrator.

or an inch and a half, raise the handle half an inch to bring the instrument in the line of the canal and continue the introduction. If care and great gentleness are observed, the operation, in the majority of cases, with No. 6 speculum, is almost painless. The average time consumed is one and a half minutes. It must be done slowly, especially in office-work, where the patient at once goes from the house to the street.

The greatest amount of resistance will be met just before the beak enters the bladder, and it is just here that the patient may first complain of pain. The amount of pressure used is hard to estimate, but is probably two ounces, and this, with an occasional rotary movement, is sufficient to allow of the insertion of the speculum into a bladder that is tender and irritable from chronic inflammation, with a minimum amount of pain at the time, and safety for the patient after she has left the office.

The examination may now be begun, bearing in mind that, in

the majority of inflammatory cases, the lesions will be found on or near the floor of the bladder (the uppermost portion when in the genu-pectoral position). Two favorite spots where inflammatory areas are apt to be found are directly in the neck of the bladder (examined last, as the tube is being removed), and to either side of the neck. The latter can only be seen by carrying the outer part of the speculum far over to the side, at least forty-five degrees from the median line. This, too, should be done slowly and gently. Much more can be elicited from the tissues by gentle and persistent handling than by a sudden force that is apt to surprise them into resistance.

When there is a tendency for the vagina to distend and encroach upon the space needed for the bladder, as is often the case where a lacerated or dilated perineum exists, the patient should gently strain and expel the air from the vagina, after the speculum has entered the bladder and before the obturator is removed, then, by pressing the

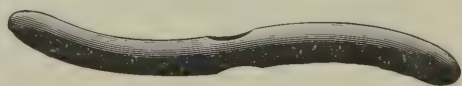


Fig. 73.—Kelly's urethral dilator.

perineum against the anterior vaginal wall and removing the obturator, air enters the bladder, and its distension is accomplished. If the ballooning is not satisfactory, the bladder being held in contact with the end of the speculum, it may be due to holding the breath, straining, an oblique position of the thighs, or a rigidity of the dorsal or abdominal muscles. See that the thighs are perpendicular and the back well curved toward the table; then, instructing the patient to breathe gently and to avoid straining, the wall will generally fall away from the speculum and permit a full examination to be made.

During the examination the accumulating drip from the ureters becomes annoying, surging up to and filling the inner end of the speculum with each expiration. This may be removed by Kelly's appliance, consisting of a rubber tube 50 centimetres in length, with a rubber ball at one extremity, and a hollow, perforated, metallic sphere 6 millimetres in diameter at the other, for introduction into the bladder. If the metal ball is replaced by the long nozzle of a hard-rubber

uterine syringe, this little contrivance will be found to answer the purpose perfectly, being more easily and quickly introduced and removed.

Dr. George E. Shoemaker devised and reported an apparatus for keeping the bladder dry. He used a quart bottle the cork of which was fitted with two rubber tubes. Through one of these the bottle is exhausted of air, and to the other is attached a ureteral catheter, which is inserted along the wall of the speculum, is too small to interfere with the field, and readily removes the urine. He has also had a small tube soldered in the lumen of the speculum, to the outer end of which the exhaust tube is attached.

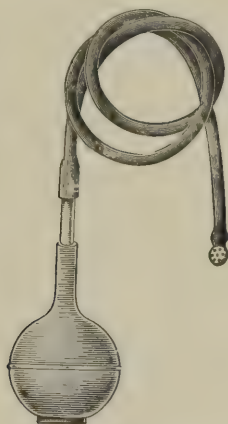


Fig. 74.—Cystoscopic syringe.

If these appliances are not at hand and the urine accumulates rapidly, a quick and ready method of emptying the bladder is to withdraw the speculum until the inner end just reaches the neck of the bladder (shown by the appearance of a narrow ring of mucous membrane at the end of the instrument), and request the patient to rise from the knee-chest position to kneeling. This brings the inner end of the speculum to a plane below the rest of the bladder and empties it at once. A short explanation to the patient satisfies her and gives her a moment's respite by changing her position. Another method—the simplest of all—is to partly withdraw the tube and ask the patient to strain gently. This brings the acting floor of the bladder

up to the opening, when by gently depressing the mouth of the instrument the desired object is accomplished.

To lessen the amount of urine excreted, see that the patient drinks no fluid for an hour before the examination is made.

It is essential that the bladder should be thoroughly distended, not only to open up all hiding-places for erosions, ulcers, or other lesions, but that the mucous membrane may be presented in its true colorings. A partially-contracted bladder is a shade darker or redder than when fully distended and might easily mislead in estimating the degree of inflammation. Several healthy bladders (with all possible aseptic precautions) should be previously examined, to learn the appearance of the normal organ.

It is not desirable to have the inner end of the speculum too near the wall. Withdraw from half to two inches, according to the degree



Fig. 75.—Ureteral searcher.

of illumination. More of the field is seen at one glance and a better idea of relations secured.

The choice of light depends upon circumstances. In the office the electric head-light, with a reliable Edison-Lalande or other battery is satisfactory, providing one is fortunate in the selection of a lamp. These may last six months or a year, or they may be destroyed in a few minutes without redress from the dealers. When connection with the battery is made the highest resistance should be interposed at first, to prevent a possible destruction of the carbon filament. Without care, one may burn out a lamp in an instant.

If, for any reason, the electric head-light and battery are not to be obtained, the light from a good lamp or gas-jet reflected from a head-mirror will give satisfactory results, and, finally, in the absence of these, similarly reflected daylight gives all the illumination necessary, and has the advantage of presenting the parts in their true and easily recognized colors. In office-work, therefore, the only essential

instruments are a head-mirror, one six-millimetre speculum, and an aluminium applicator. A clear recollection of the nervous and vascular supply to the various organs of this region will go far toward a correct interpretation of symptoms, and the intelligent application of the proper treatment. One will lose no time in becoming thoroughly acquainted with the essential and relative anatomy of the parts.

Applications through the cystoscope are best made with a slender aluminium applicator, carrying a thin layer of cotton on the end. Care should be taken not to wrap too thickly, to avoid pinching a fold of mucous membrane against the sharp edge of the tube when withdrawing the applicator. The latter may be so thinly, yet serviceably, wrapped with cotton that the eye may follow it down the No. 9 tube to the spot to be touched, thus confining the medicine to the area needing it.

An important feature in connection with cystoscopy is the examination of the ureters. These pass diagonally through the wall of the bladder and enter it about 1 inch in front of the uterine neck, and $\frac{1}{2}$ to $\frac{3}{4}$ inch from the median line. In order to bring them into view, the speculum should be turned about thirty degrees from the median axis, and, with the patient in the genu-pectoral position, the handle is depressed until the mouth of the ureter is brought into view. The appearance of this opening is not always the same, and is, at first, rather difficult to find. It may appear as a small dimple with pouting edges, a small slit, or an area of deeper color than its surroundings. A fairly accurate guide is found in the jet of urine issuing from it. If the kidney and ureter of the side under observation are intact, a small, shining line of urine may be traced upward to its emergence.

In rare conditions, probably of unusual stimulation of the ureteral muscular fibres, the mouth of the ureter is unexpectedly indicated by the appearance of a tiny stream of urine, such as would be projected from an hypodermic syringe, forcibly ejected across the inner opening of the speculum, sometimes striking its lower wall with a faintly audible tinkle.

Further discussion of the examination of the ureters will not be entered upon here, but attention is called to the fact that inflammation of the lower end of these tubes may, at times, be the cause of hitherto obscure and persistent backache, evidenced by the testimony of the patient, when the sound enters the canal, that there is where

the trouble lies, and, afterward, by the disappearance of the symptom after proper treatment.

The color of the mucous membrane lining the bladder varies very much in different people, and at different times in the same subject. It is several shades darker for a week before the menstrual period, increasing as that time approaches, rendering it desirable not to examine at that time, except when the lesion is a very light one. It is then better to select that period, as an area of hyperemia that was not visible before, becomes plainly so during the period of pelvic turgescence. It would be well, in such a case, to make two examinations: one a week after the menses have ceased and one the day before it is again expected. The contrast would indicate the relative integrity of the different capillary areas.

The average color of the healthy bladder is pale-flesh color, with occasional reddish or bluish streaks, very fine, generally short—not over half an inch, and sometimes dichotomous. These are the small veins, and are rarely altogether absent. The shade deepens as the neck of the bladder is approached, and at the sphincter is apt to be a deep red, which continues with gradual paling along the urethra to within a quarter or half an inch of the ostium, when it reaches the shade as seen without the speculum's aid.

Let each case be carefully and gently handled, both to avoid injuring the tissues and to reassure the patient's mind. Frequently the first attempt to examine an extremely nervous patient induces marked mental distress, and requires judgment as to whether to continue the efforts or wait until another time.

The air contained in the bladder is variously disposed of. If the treatment does not extend to the urethra, use the same procedure mentioned when speaking of the disposal of the accumulating urine: withdraw the speculum to the inner extremity of the urethra, place a small receptacle under the mouth of the instrument, and request the patient to rise to the kneeling posture. Urine and air escape, the bladder collapses, and the speculum is entirely removed.

If, as is often the case, the urethra likewise needs to be treated, the application is made during the slow withdrawal of the speculum, leaving the bladder distended with air. A soft-rubber catheter may easily be inserted and the viscus will be emptied when the patient either stands up or lies down.

Occasionally, when making applications at the patient's house,

the rubber catheter is permitted to remain *in situ* for a variable length of time: from half an hour to four hours. This prevents a diluting of the medicament, and allows a longer period for its action upon the mucous membrane, but must be done tentatively, to avoid irritating it.

While it is not desirable to have a patient leave the office with air in the bladder, yet, should this occur, it rarely need cause anxiety. It is usually voided upon reaching home, with the first attempt to pass the urine, and is seldom followed by untoward results.

DISEASES OF THE RECTUM AND SIGMOID FLEXURE.

The frequency with which the physician in the practice of gynecology encounters diseases of the rectum makes it wise to add a few paragraphs on these conditions in which electricity is of signal service. This is an electro-therapeutic field that has been much neglected in spite of good work that has been occasionally recorded.

Anal Fissure.—In cocaine cataphoresis we have an excellent and almost painless method of healing these troublous conditions of the anal outlet, which will frequently make divulsion of the sphincter unnecessary. The patient is placed in position for examination, preferably leaning forward, face downward, over the head-end of a couch, and the anus carefully examined in the light of a head-mirror or electric head-light. When the painful erosion or fissure has been found the small pad is slipped under the abdomen and made negative, while the positive electrode, of platinum or carbon covered with absorbent cotton dipped in a 10-per-cent. solution of cocaine hydrochlorate is applied to the erosion and from 1 to 5 milliampères turned on for some minutes. Usually one application is sufficient to promote healing; at any rate it should not be repeated until a sufficient time has elapsed to test the possibility of healing having occurred.

Hemorrhoids.—Both external and internal hemorrhoids are readily and radically cured by making use of the coagulative and styptic action of electricity within the pile by means of puncture. Thanks to the anesthetic value of cocaine cataphoresis this procedure may be made almost painless, and the subsequent discomfort during the healing process is less than by any other method. The electric method, while radical in results and free from danger, possesses, therefore, the advantages of being possible without general anesthesia.

The patient being in the position described in preceding paragraphs, the pile is exposed to a good light, those within the sphincter by means of a rectal speculum, and a carbon or platinum electrode with cocaine solution on cotton applied as already described. The cocaine electrode is made to cover the most prominent portion of the pile which is intended to be punctured and the material diffused by anodic cataphoresis for about seven minutes with a current of 15 to 25 milliampères according to the discomfort produced. At the end of this time a small platinum needle on a staff some six inches long (Fig. 76), insulated to a half-inch from the point, is inserted with but little sensation and a current of 5 to 20 milliampères turned on for ten minutes; a blanching effect is soon seen to occur in the pile, and the instrument may be withdrawn without bleeding from the point of insertion if sufficient current has been used.

This puncture will probably be sufficient for the one hemorrhoid; at any rate, healing should occur before repetition in that



Fig. 76.—Author's hemorroidal needle electrode (sectional view, showing appearance when coated with shellac).

tumor, but other tumors should be sought for and a similar cataphoric application and puncture made at the same sitting if the patient's endurance of the posture continues long enough. If the needle has been insulated in such a manner that an eighth of an inch of the shellac insulation will follow the point into the pile, further insertion being guarded against by a shoulder or bulbous portion of the insulation at the proper spot, the after-treatment is very slight, consisting of cleansing injections of hamamelic extract or a weak solution of acetanilid after defecation with occasional applications of an ointment of either of these agents by means of a rectal ointment-applicator.

Prolapse of the Rectum.—Moderate degrees of this mechanical displacement of redundant rectal walls may be successfully treated by a combination of two methods: labile intrarectal applications of the positive pole of a combined galvanic current of 20 milliampères and the primary faradic (the author's rectal electrode [Fig. 67] being used) and submucous puncture.

The purpose of the labile rectal application of both currents is the stimulation of the muscular walls of the rectum and the various muscular structures adjacent, in order that the normal tone may be restored. This is usually followed by an immediate retraction of the protrusion, which frequently remains in proper position for increasing periods of time after this simple application. If made daily it may cure moderate conditions of prolapse without further elaboration of method. In the absence of the amalgamated-zinc electrode, with which it is proper to employ the positive pole (the mercury preventing cauterization under the moderate current and constant movement advised), the negative pole may be used with a rectal olive of any metal. The Sims position is usually the most convenient for this maneuver.

The purpose of the submucous puncture is the production of a cicatricial adhesion between the redundant walls and the underlying areolar tissue. Either pole may be used, the position of patient and anesthetic cataphoresis being the same as described in the puncture of hemorrhoids. The needle is inserted at but a slight angle with the longitudinal axis of the rectum, and about 20 milliamperes used for ten minutes. But little can be accomplished by puncture, however, as the adhesions produced in such a manner are evanescent.

Stricture of the Rectum.—The unsurpassed value of electricity in strictures of the rectum is well shown in Newman's article in the "International System of Electro-Therapeutics." Its special action here, as in other strictures, is the dilating and softening effect of the negative pole and the possibility of causing absorption of the cicatricial fibrous structure causing the stricture. The size of the bulbs required makes it possible, as well as necessary, to use much more current than in the urethra, with added boldness of technique.

The instrumental equipment, in addition to the usual abdominal pad for a dispersing pole, consists of a rectal electrode with shank about nine inches long to which three or four sizes of bulbs may be screwed, varying in diameter from one-third to one inch. Semi-elastic shanks have been advised by some writers and repeatedly used by the author, but are rarely satisfactory in the firmer or narrower strictures, owing to one's inability to direct the bulb properly. An important improvement applied to these electrodes by the author is shown in Fig. 66, which is tunneled for attachment to a syringe in order that a cushion of water or oil may be made to precede the

instrument, dilating the natural channel up to the point of the stricture.¹

Essential elements of success in this work are a knowledge of the anatomy of the rectum and of its several sphincters, and extreme gentleness in passing the electrode to the contracted spot, where but slight pressure is demanded, the dilating effect of the current of 20 milliampères or more being relied upon.

Should the stricture bear evidence of being due to a malignant growth, the fact that the author's electrode bulbs are of zinc comes in play, since when well amalgamated the polarity of the instrument may be changed to positive after the diseased spot has been reached and a stronger application of mercuric cataphoresis made before it is withdrawn, as in the ulcerative conditions described below.

Ulcerations and Adenoids of the Rectum.—For these conditions the mild zinc-mercuric cataphoresis is indicated, with current-strengths of 30 to 50 milliampères applied from olive-shaped zinc instruments. The results are most excellent, and could probably be attained in no other way.

¹The author does not claim the tunneled rectal electrode as a novelty, except as applied to a dilating instrument for the upper rectum, hollow rectal electrodes having been devised by Boudet, King, Cleaves, and others.

CHAPTER XXI.

THE COSMETIC APPLICATIONS OF ELECTRICITY.

THE chief cosmetic uses of electricity, in addition to the restoration of a normal clearness of complexion by a galvanic stimulation of the liver and other abdominal organs, is the destruction of superfluous hairs on the face or elsewhere, the removal of small surface-tumors of the skin, moles, and warts; of nevi, or port-wine marks; and of pigmented nevi. Electricity, or, more particularly, the solvent action of the negative pole of the galvanic current, is, in every way, the best method of removing these blemishes, which, when situated on the face or other conspicuous portion of the skin, not only mar the appearance of the person, but are often responsible for an unhappy disposition in the persons thus afflicted. The skillful application of the proper remedy for these deformities is not the highest work of the educated physician, it is true, yet it is by no means beneath him, and, when it is remembered that the proper performance of the work demands a considerable knowledge of the anatomy and pathology of the skin, it is his duty to rescue it from the hands of ignorant charlatans.

Superfluous Hair.—The destruction of superfluous hair is accomplished by the electrolytic destruction of the germinal papilla at the bottom of the hair-follicle, and it may be said that there is no other known way in which this may be done without destruction of the adjacent skin. The world is indebted to Dr. W. A. Hardaway, of St. Louis, Mo., for the discovery of this fact, which has been further elaborated by Dr. George H. Fox, of New York, and the late Dr. Plym. S. Hayes, of Chicago. The pole employed is invariably negative and a current-strength of from $\frac{1}{2}$ to $2\frac{1}{2}$ milliamperes is sufficient, according to the size of the hair and the duration of the application, when it is concentrated at the point of a fine needle inserted into the follicle. This amount of current may be obtained from a variable

number of cells when a controller is used, though it is thought to be more painful if the voltage is greater than that obtained from about twenty cells. As the physician will be most apt to use the same apparatus for this work as that employed in ordinary therapeutic applications, it is only necessary to cut out some cells by a switch-selector or otherwise attach that number of cells to his switch-board.

The special instruments required are a needle and a pair of epilating forceps, the latter to be broad-pointed, non-serrated, and with a weak spring.

A proper needle is a matter of extreme importance, since it is necessarily very fine to traverse the smaller hair-follicles which are already nearly filled with the hair themselves, yet the point should be so blunt as not to pierce the sheath of the follicle, but merely follow the hair to its base. Specially-ground jewelers' broaches have been generally recommended, of steel, since the negative pole is invariably used, but I have preferred one less easily broken, which has been made from hard, gold spectacle-wire. This is ground fine and with a very small bulbous point. The handle should be light and without any current-breaking mechanism, as is sometimes mistakenly added, the cord to be attached being unusually light. I have in some instances succeeded in insulating the needle a few lines above the point by fusing a light coating of hard rubber on it. This will permit the electrolysis to be restricted to the point, beneath the actual surface of the skin, and will lessen pain and scarring.

The patient is placed in a large chair by many, but the writer prefers in this and all other face applications that she lie on a couch in a good light with her head well up on the head-piece, the operator sitting behind and leaning over with his elbows resting on the side of the pillow. The poles of the battery are thoroughly identified and the positive binding-post connected with a moist pad laid on a towel in her lap, on which the patient presses her hand to close the circuit and raises it therefrom to break it at command, the pad becoming thus a delicate controller to make and break the circuit without suddenness.

Everything being in readiness, the needle, connected with the negative pole with an appropriate cord or very fine insulated wire, is inserted into the follicle without piercing its walls, the patient is directed to press the pad, the proper amount of current is turned on through the Massey controller, which is not thereafter disturbed, and

the action of the current noted. When the hair is loosened, as it will be in a few seconds, if the needle has been properly placed, it is removed by the forceps in the other hand of operator; the patient is directed to raise the hand, when the needle is removed, reinserted into another follicle, and the process repeated. The patient's hand is always up, therefore, when the needle is either inserted or removed, greatly lessening the pain, which is often considerable. After the skin has been broken by an application a strong solution of cocaine should be spread over the surface, and though the polarity of the electrode will not carry much of it in by cataphoresis a distinct dulling of sensation will be soon manifest from it, doubtless by absorption through the little punctures made. If four hairs are removed at the angles of a surface a little over a half-inch in area the inclosed space quickly becomes anesthetized, permitting the hairs within it to be removed at this sitting without sensation. But it is not wise to remove hairs closely contiguous, owing to the tendency of the little cauterizations to coalesce, producing too palpable a scar.

The *séance* should not be prolonged beyond a half-hour at a time, in the interest of both patient and operator.

A few hair-papillas will escape destruction at the hands of even skilled operators; but they are readily removed when they reappear. To guard against an undue number of these, care should be observed not to remove the hair until it is thoroughly loosened.

Moles and Warts.—The special advantage of negative electrolysis in the removal of both moles and warts is that it enables us, by a nice adjustment of the destructive action to the actual tissue to be destroyed to devitalize the little tumor at one sitting without the destruction of the underlying skin as with acids or the knife, the slight scar left for a few weeks disappearing entirely after a time. The details are practically the same as for the removal of a hair, except that a sharp needle is used, passed into the growth a little distance above its base, and that about 5 milliamperes is usually required, turned on very gradually. The current should be continued until the growth is quite disintegrated in the case of moles, but warts often disappear after only a partial destruction of their bases, apparently by an influence on their nutrition. In either case the crusts should be left undisturbed until they fall off, to avoid scarring.

Nevus Vasculosus (Port-wine Mark).—This congenital dilatation of the capillaries of the skin is at times of large extent, constituting

a serious disfigurement. Its treatment, which necessitates an occlusive inflammation of the capillaries, is both tedious and painful, yet the results attainable are fully worth the effort. The active pole, negative, to avoid undue scarring, consists of a number of needle-points projecting from a disk, enabling as many punctures to be made simultaneously. The current is empirically regulated and maintained (at about 3 milliampères per needle) until a white wheal appears at each puncture, when it is turned off and the instrument reapplied at another place. The result of each healed puncture is a minute white scar at its site, and it is therefore necessary to repeat the application a number of times at intervals of a month in order that the whole surface may be turned into a slightly roughened cicatrix, which is far more sightly than the nevus.

The application is quite painful and for a thorough treatment it is wise to employ anesthesia, particularly since the applications are necessarily at long intervals. It is possible that if the needles were of irido-platinum and the positive pole used the greater scarring from short applications would be of advantage, but the author is not aware that this has been tried.

Nevus Pigmentosus.—This form of nevus, characterized by the deposit of pigment within the skin and frequently by the associated growth of superfluous hairs, is treated in the same way as the vascular nevus, the hairs being first removed in the usual way. The pigment is, at times, apparently decomposed by the electrolysis, the metallic constituents being deposited on the negative needle.

PART II.

RUDIMENTS OF MEDICAL ELECTRICITY.

CHAPTER XXII.

PHYSICS OF THE GALVANIC, OR DIRECT, CURRENT.

WHILE our knowledge of the true nature of electricity itself is yet indefinite, it is fortunate that its manifestations in motion—the only condition in which it is of service to physicians—are as real, comprehensible, and measurable as a simple current of water. If there is mystery attending its use in medicine it is the mystery of all remedies applied to yet imperfectly understood physiologic and pathologic processes.

Certain facts relating to their non-compressibility have led recent investigators to regard electric currents as currents of a real fluid. Be this as it may, the fact that their laws in motion are exactly analogous to those of hydraulic currents has enabled us to frame a definite mental picture of them, and assists us greatly in a comprehension of their qualities.

If we examine a stream of water issuing from a reservoir (Fig. 77) we will find two qualities which will not be difficult to separate in the mind: pressure and volume. The former is the force by which water transports itself, due to gravity, and depends on the height of the water in the reservoir. It is the same in all pipes issuing from it, whether large or small. The volume of water carried by a pipe, on the other hand, depends on the size and length as well as on the pressure.

Electromotive Force (Pressure).—In electric currents the force
(277)

governing the transportation of the energy is called electromotive force, due to a kind of electric gravity, or heaping up of energy at the positive pole. This force is likewise independent of the size of the conductors attached to its reservoir, but the bulk, or volume, of the current will depend on the size and length of the conductor as well as on the electromotive pressure.

Just why a contrivance such as a galvanic cell should give rise to the pressure leading to current-flow is not so clear as is the analogous pressure-origin in water-currents. It is easy to conceive that

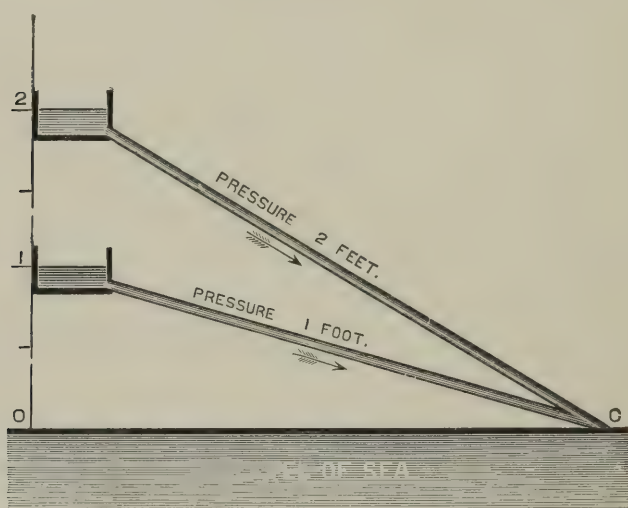


Fig. 77.—Diagrammatic representation of the cause of flow in hydraulic currents. The pressure, measured by a vertical scale of feet, is due to the elevation of the source, or reservoir. The amount of water delivered will depend on the calibre of the pipe as well as on the height of this pressure.

a water-current will flow downward through pipes by virtue of the actual weight of the water, the available weight being proportional to the vertical height of the water-column. All that we know of the cell-origin of electric pressure is that it is an inherent quality of any two metals that one is positive to another when both are plunged into an acid or saline bath, and that a current starts from the submerged surface of the positive element toward the submerged por-

tion of the negative element and emerges at the unsubmerged portion of the negative element. The *upper portion* of the negative element (Fig. 79) is, therefore, the *positive pole*, as it is at this point that an accumulation of electric energy occurs in a cell, while a corresponding deficiency is found at the *upper portion* of the positive element, constituting the *negative pole*. When the two poles are united by a conductor, such as a wire, the body, etc., a current flows from the positive pole to the negative pole in response to nature's effort to re-establish an equilibrium. It is, however, the peculiar virtue of a good cell that the difference of level is maintained by chemic action

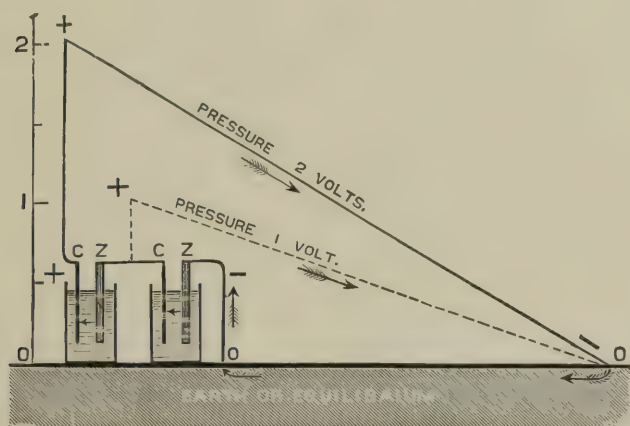


Fig. 78.—Diagrammatic representation of the cause of flow in electric currents. The pressure (or electromotive force), measured by a scale of volts, is due to the elevation of the electric level of the positive end of the conductor by the particular generator in use. The amount of current delivered will depend on the size and conductivity of the wire as well as on the height of this pressure.

between the liquid and the elements, resulting in a constant maintenance of the pressure at the positive pole and a continuous current-effort at equilibrium until either the chemic activity of the liquid is exhausted or the positive element is consumed. We can ascertain the direction of the current always by knowing that it is invariably the positive element that is consumed, on the surface of which the current begins. By knowing this, we know that the outer portion of the

opposite plate is always the positive pole of the cell. It so happens that zinc is almost invariably used as the perishable element in a cell, and usually carbon the unattacked element; hence the positive pole of such a cell is the outer portion of the carbon, or a wire attached to it.

A galvanic cell with its circuit "open"—*i.e.*, without conducting material connecting its poles—may be said to resemble a small reservoir full of water with the outlet closed and ready to supply a current to a pipe. When the poles of the cells are connected and a current flows it is like the same reservoir with valves open, supplying a current of water to its pipes, the water-level in the reservoir being

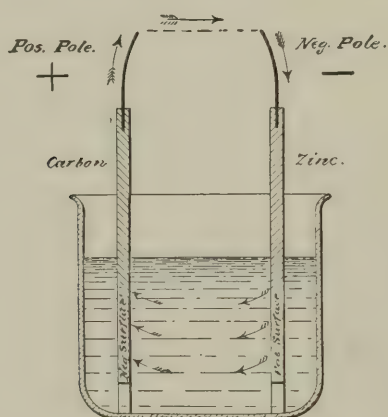


Fig. 79.—Diagram of direction of current within a cell.

maintained by pumps that are analogous to the chemic action within the cell.

But the galvanic cell is by no means the only method by which electromotive force may be created. Fig. 80 indicates how a dynamo, electric machine, or induction apparatus may cause a pressure by heaping up energy at the positive pole, showing its analogy to a pump.

The Volt.—The unit of electromotive force, or pressure, is the volt; so named after Volta. It has been derived from mathematic calculation, based on fundamental units of length, mass, and time,—the centimetre, gramme, and second, or C. G. S., system of units.

The physician, however, needs but to remember that the practical volt is almost exactly the amount of electromotive force produced by a good zinc and copper cell, known as the Daniell cell. Two such cells, arranged in "series" as in Fig. 78,—that is, with the zinc of the first connected with the copper of the second,—will raise the potential in the circuit to two volts. Five such cells will give five volts and ten cells ten volts, the unconnected copper of the first cell being the positive pole of such a battery and the unconnected zinc of the

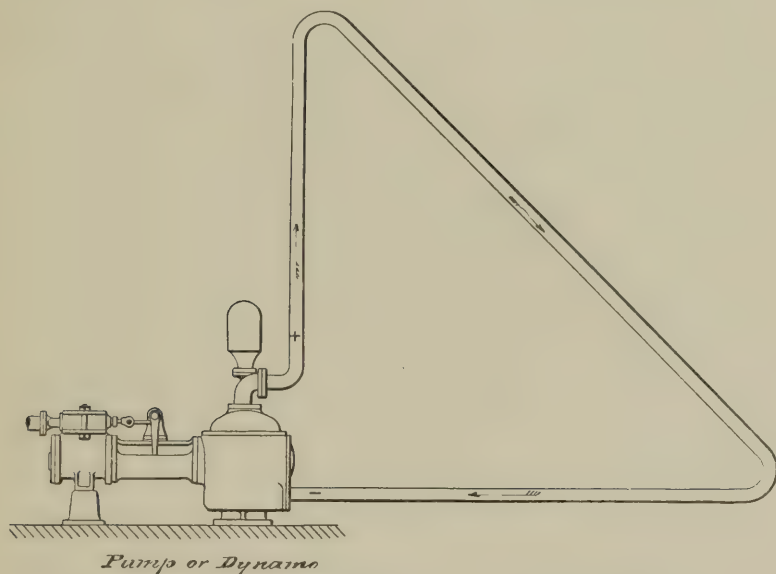


Fig. 80.—Diagram showing analogy of laws governing pressure in pump and dynamo circuits.

last cell the negative pole. Of the cells in medical batteries it may be said that all zinc and copper cells possess an electromotive force of about one volt, zinc and silver cells about the same, and zinc and carbon cells about one volt and a half. An ordinary portable battery of thirty zinc-carbon elements, such as is largely employed with acid solutions, gives, therefore, a current with a pressure of about forty-five volts when in good condition.

Resistance.—It was said above that the pressure of an hydraulic

current from a reservoir of a certain height was independent of the size of the pipes through which it issued, being the same whether the pipe was large or small. The amount of water passing through the pipes will, however, depend on their calibre and the frictional resistance of the water against the sides of the pipe. The calibre of an electric conductor is equally important in regulating the volume of the current that will pass through it from a given pressure, while a certain frictional resistance to electric conduction exists in the metallic conductor itself not unlike the internal friction of the pipe.

The Ohm.—The adopted unit of resistance is the ohm, named for Professor Ohm, of Germany, and is equal to the amount of resistance presented by a column of mercury one metre high and one millimetre thick. A more convenient idea of this amount of resistance is conveyed by the statement that it is equal to that presented by a wire of pure copper two hundred and fifty feet long and one-twentieth of an inch in diameter. Five hundred feet of such wire will give two ohms resistance, and one thousand feet four ohms. On the other hand, if the two hundred and fifty feet of copper wire be twice the area in cross-section it will give but a half-ohm resistance, and so on.

The resistance of a conductor is therefore directly as to its length and inversely as to its cross-section.

Specific Resistance.—Homogeneous conductors, such as metals or solutions of definite proportions, present differing resistances, however, even in conductors of the same size and length. A one-twentieth-inch iron wire, two hundred and fifty feet long, for instance, will present a resistance of 5.36 ohms, because an iron wire of the same size and length has a resistance 5.36 times greater than copper. This differing facility of conduction is an inherent quality of different substances, and is called their specific resistance. It is probably due to a frictional resistance to flow presented by the constituent molecules of the conductor. The resistance of copper is taken as the unit of comparison, or 1.

TABLE OF SPECIFIC RESISTANCES.

<i>Metal.</i>	<i>Specific Resistance.</i>
Silver	0.77
Gold	1.38
Aluminum	2.29
Zinc	2.82

<i>Metal.</i>	<i>Specific Resistance.</i>
Iron	5.36
Tin	6.76
Platinum	7.35
Lead	9.96
German silver.....	10.09
Antimony	18.07
Mercury	47.48
Bismuth	64.52
Graphite	1106.00
Gas-carbon	2037.00

The Law of Ohm.—In hydraulic currents it has been said that the volume of the water circulating in a pipe will depend on the pressure, on the one hand, and the calibre and length of the pipe on the other. The corresponding relation of pressure and resistance to current in electricity is known as Ohm's law, having been formulated by Professor Ohm in 1827. It is mathematically expressed by the formula

$$C \text{ (current)} = \frac{E \text{ (electromotive force)}}{R \text{ (resistance)}}$$

or that the current is equal to the electromotive force divided by the resistance.

Units of Current.—*The Ampère.*—The amount, or volume, of current circulating in a conductor is measured in ampères. This unit of current-volume is fixed as the amount circulating through a resistance of one ohm from a pressure of one volt. A Daniell cell would, therefore, maintain an ampère through two hundred and fifty feet of one-twentieth-inch copper wire if its own internal resistance could be excluded.

The Milliampère.—For medical purposes the ampère is too large a unit; hence the milliampère, or one-thousandth of an ampère, is used for this purpose.

The Coulomb.—The current delivered every second by a circuit having a pressure of one volt and a volume of one ampère is equal to a coulomb, the unit of measure for current-quantity. This unit, or its corresponding diminutive, the millicoulomb, is rarely used in medicine, unless electrolysis alone and not the additional effects of more or less suddenly applied volume are required. A record of the milliam-

pères used and the duration of the application conveys more information than a mere record of the millicoulombs would.

Internal Resistance of Cells and Batteries.—In a circuit made up of a battery and external conductors there are two kinds of resistance to be reckoned with in estimating the whole amount to be encountered,—viz., the internal resistance, or that given by the solutions and elements within the cells, and the external resistance, or that given by the wires, cords, electrodes, and body. Incandescent currents

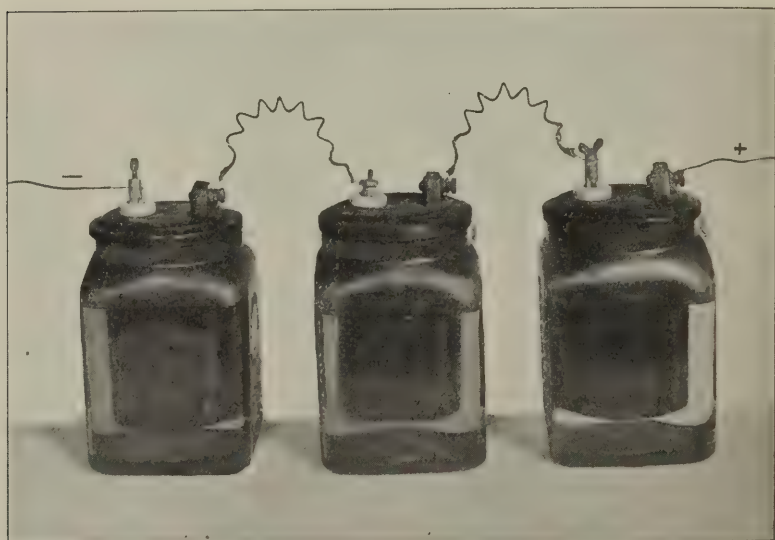


Fig. 81.—Three cells connected "in series."

may be said to have external resistance only, as the internal resistance of the vast reservoir made up of street-mains, dynamos, etc., is too small to require the physician's attention from this point of view.

Application of Ohm's Law to the Arrangement of Cells.—The various needs of electricity in medicine require that currents of varied pressure and volume be used, the pressure being employed, as a rule, merely for the purpose of carrying sufficient volume through the tissues. If but a milliampère or so is required the pressure need not be great, but if a large volume is desired to be passed through the

poorly conducting skin the pressure must be from fifty to a hundred volts. A single Leclanche cell gives a pressure of about one and a half volts. To get a current of seventy-five volts from a battery of such cells we must arrange fifty of them "in series," as in Fig. 81,—that is, with the zinc of the first attached to the carbon of the second, and so on. Such a current will have sufficient pressure to carry the usual amounts of milliampères required in medical applications, but it will not heat a cautery-knife, because it will be impossible to get



Fig. 82.—Three cells connected "for surface," or in parallel arc.

more current-volume from the whole battery thus arranged than can be obtained from a single cell on short circuit (or working with its poles connected directly without appreciable external resistance), because its output will be limited by its own internal resistance. To increase the output in the latter case we must decrease the internal resistance, which is done by either increasing the size rather than the number of the cells, or by arranging the cells "for surface" or in multiple arc,—that is, with all the carbons connected together as the one positive pole and all the zincs connected together as the negative

pole, thus making them one cell many times larger than the original one (Fig. 82). The internal resistance in this latter arrangement is decreased by broadening the path of the current through the battery itself. By a computation of the internal resistances of cells and a calculation of the pressure required to overcome the external resistance we can easily tell whether we need a few large cells or many cells that do not need to be large.

To the mathematic mind but little effort is required to comprehend such facts. To those rusty in figures I commend the following graphic delineation of the law of Ohm as applied to currents from cell-batteries, an ideal cell with an electromotive pressure of one volt and an internal resistance of one ohm being depicted for convenience of illustration:—

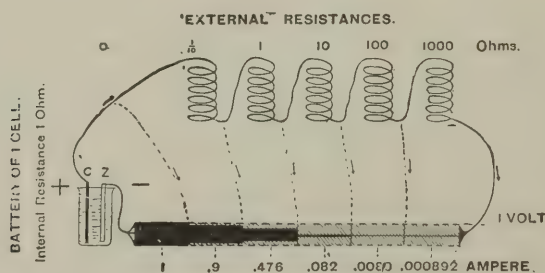


Fig. 83.—Graphic delineation of the pressure and volumes of currents from a single galvanic cell when various resistances are inserted into the external circuit. The cell shown at the left of the cut has an electromotive pressure of one volt and an internal resistance of one ohm. The divisions of the drawing to the right of the cell represent imaginary longitudinal sections of the currents obtained on short-circuiting the cell and after successively inserting into the circuit the several resistance coils indicated in the upper portion of the figure. The heavy shading in the first three divisions shows the exact proportions of volume to the eye as compared with a full ampère, indicated by a broken line. The light shading shows the proportion of pressure, which is uniformly maintained throughout. The volume in the last three spaces is indicated by the figures beneath, but is much too small to be shown to the eye on the scale adopted.

Fig. 83 shows to the eye the effect made on the current-volume from a single cell by inserting various amounts of resistance into the external circuit. The cell has a typical pressure of one volt and a

typical internal resistance of one ohm. When its terminals are joined by a short band of copper, so thick as to present no appreciable resistance, the current-volume produced is one ampère. If, now, the short band of copper be replaced by a coil presenting a resistance of one-tenth ohm, making, together with the internal resistance of the cell, a total of one and one-tenth ohms, the resultant volume will be diminished to nine-tenths of an ampère.

When another coil, giving a resistance of a full ohm, is added,

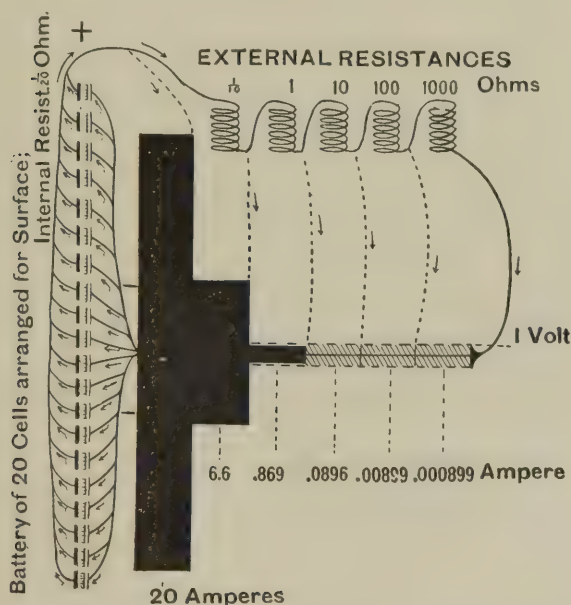


Fig. 84.—Graphic delineation of the pressure and volumes of currents from a battery of twenty cells arranged "for surface." The battery, acting as an enlarged cell, has an electromotive pressure of one volt and an internal resistance of one-twentieth of an ohm. The first three imaginary current-sections show the proportions of volume to the eye.

the total now being two and one-tenth ohms, the volume maintained is less than half an ampère. A corresponding reduction of the volume occurs, with the inclusion of each additional amount of resistance in the external circuit; and when the whole series of coils is placed in circuit, aggregating, together with the internal resistance,

a total of one thousand one hundred and twelve and one-tenth ohms, the current-volume is brought down to less than nine-tenths of a milliampère.

The resistance of the body with approved electrodes may be said to be represented by the last two coils of the figure (from one hun-

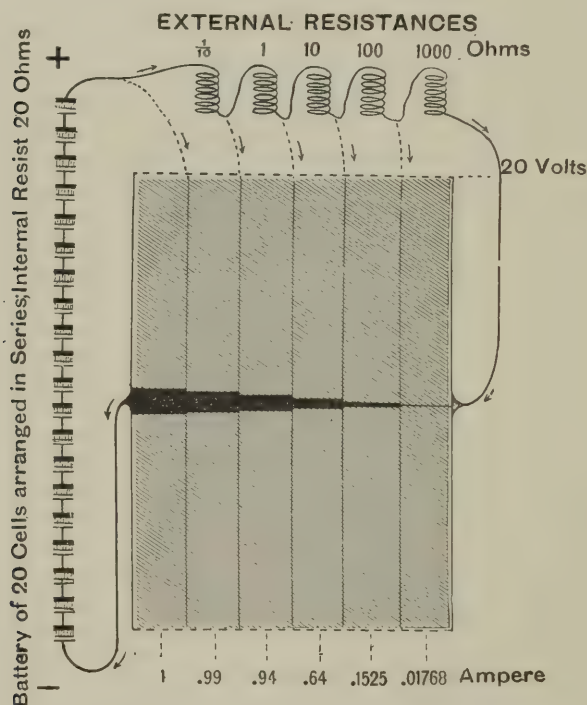


Fig. 85.—Graphic delineation of the pressure and volumes of currents from a battery of twenty cells arranged "in series." The battery has an electromotive pressure of twenty volts and an internal resistance of twenty ohms. The heavy shading in the first five imaginary current-sections shows the exact proportion of volume on the scale of the preceding cuts. The space allotted to represent pressure is reduced, for convenience, to one-half the scale adopted in Figs. 83 and 84.

dred to one thousand ohms), while that of the platinum loop of the galvano-cautery knife is nearest that of the first coil. The effect of increasing the cell to twenty times its size (or coupling twenty similar

cells for surface, *i.e.*, all the zines to one pole and all the carbons to the other), is shown for both uses in Fig. 84, demonstrating the value of the method with the slight external resistance and its inefficacy for the greater. The effect of an increase in the voltage in passing more current through the higher resistances is shown in Fig. 85, which also displays the disadvantage of this method in the low resistances, as the additional cells bring with them additional internal resistance.

CHAPTER XXIII.

THE PRODUCTION AND CONTROL OF GALVANIC CURRENTS.

THE galvanic currents used in medicine are procured from batteries of cells arranged to give sufficient voltage (from 10 to 150 volts, according to the nature of the medical work) or from reliable direct-current incandescent lighting-mains, the latter usually having a pressure of 110 volts. In either case the currents are modified by an applying apparatus consisting essentially of a controller and meter, with the necessary switches and binding-posts. Where reliable Edison incandescent circuits are available that are either under the absolute control of the operator or placed underground and kept free from danger of contact with arc-light and trolley-car wires and kept constantly supplied with current, there is no reason for the physician to use a battery as a source of current. All batteries require intelligent care and are likely to give more or less trouble in replenishing and repairs, all of which is relegated to the dynamo-house in the case of incandescent circuits. Yet no one should begin the use of an incandescent circuit until he has assured himself by investigation that his circuit is free from the defects and dangers referred to.

SOURCES OF CURRENT.

The Incandescent Circuit.—Being assured that there will be no possible interruption of the current to be delivered from the 110-volt Edison direct-current mains,¹ its use in medical applications is very simple, the two supply-wires being attached to the apparatus, whether it be a cabinet or table switch-board, just as the wires leading from the carbon and zinc elements of the battery are attached. The polarity of each wire should first be tested as described on page

¹ The Westinghouse system of incandescent house-lighting, so largely used in smaller towns, employs an alternating current totally unlike those considered here, and, of course, lacking in the properties of a direct current. Its employment in medicine is referred to elsewhere.

312 and labeled, the positive wire being permanently attached in the place arranged for the wire from the carbon pole of the battery and the negative in that for the zinc. Two precautions are, however, essential, one being that the electrician should insert a fuse between the mains and apparatus to permit not more than one ampère of current to circulate through it; and the other that no switch that will short-circuit the current be permitted in the cabinet or other apparatus. These precautions are to be observed to preserve the meter and other apparatus from burning out, and they are both important on that account, particularly the rearrangement of switches, since all

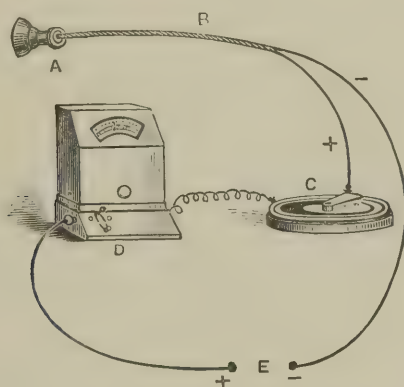


Fig. 86.—Diagram of circuit arrangement for using incandescent current. A, lamp-socket with plug inserted; B, double conductor; C, controller; D, meter; E, electrode binding-posts.

the older apparatus and batteries have switches that short-circuit the cells every time they are turned.

If a separate meter and controller are used instead of the permanent switch-board they should be connected up when used, as shown in Fig. 86, after testing and marking the polarity of the incandescent terminals. One wire is connected directly with one of the binding-posts for the electrodes¹; the other conductor is carried to one binding-post of the controller; from the other binding-post of the controller a wire is led to one binding-post of the meter, and from

¹ It would be wise to have a one-ampère fuse inserted on this wire.

the other binding-post of the meter a wire is led to the remaining electrode binding-post. The electrode binding-posts should now be marked with their respective polarity signs.

In handling the electrodes and cords of an incandescent circuit thus arranged one must be careful not to bring the metallic parts of opposite poles together unless the controller is turned off. This precaution is merely to preserve the fuse or instruments from being burnt. There is absolutely no other danger from the use of a proper

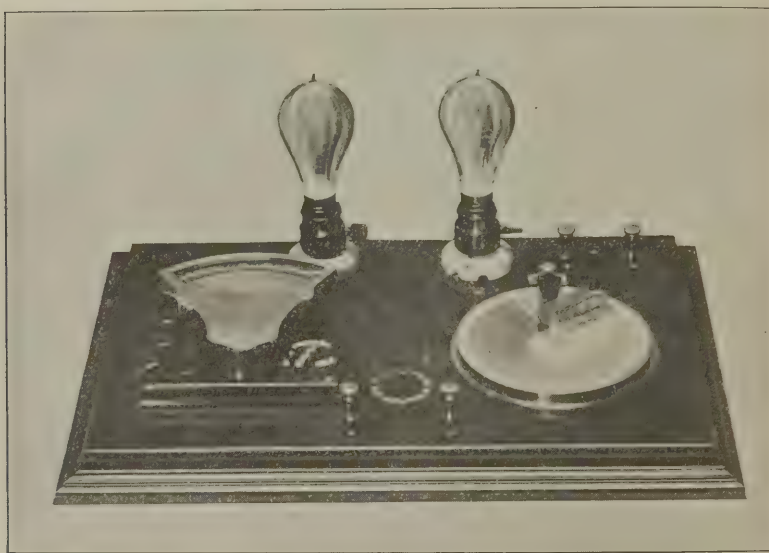


Fig. 87.—Author's switchboard for obtaining the galvanic current from the Edison incandescent mains.

circuit of the Edison current, as the full strength of this circuit can force no more current through the body than can the full strength of any good battery of seventy or eighty cells. To avoid such accidents to the apparatus the controller should always be kept with the crank at the starting-point when not in actual use, and the metallic parts of the electrodes and cords should never otherwise be brought together.

When currents of moderate strength are to be used it is some-

times an advantage to reduce the pressure of the Edison current by inserting a lamp in the circuit with the controller, meter, and patient, or the patient may be placed in a shunt circuit at will as in Fig. 88.

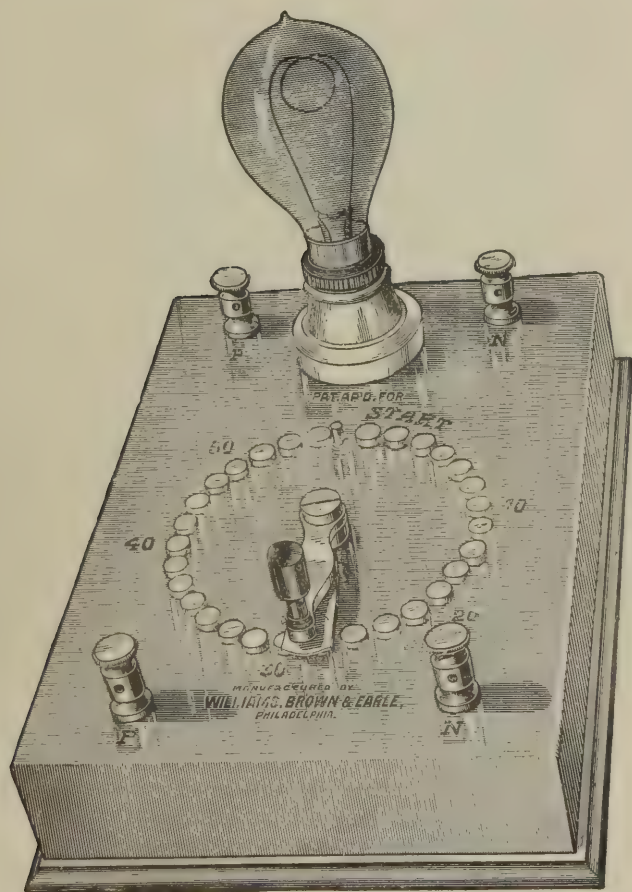


Fig. 88.—Geiger shunt-controller, or volt-selector.

To place the patient in a shunt circuit means that the current is split into two routes, the one in which the patient is placed being capable of such variation of resistance, in relation to the other circuit, as to take more or less of the total voltage.

An improved Massey controller, made on the shunt principle, specially adapting it to the Edison current, is shown in Fig. 89. This may



Fig. 89.—Improved Massey current-controller. The patient is placed in a shunt circuit.

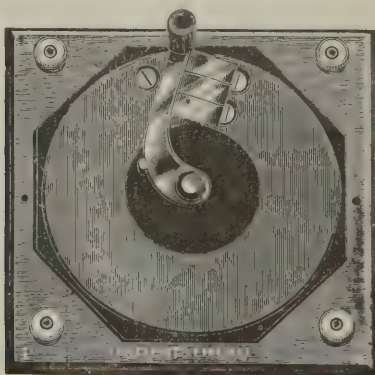


Fig. 90.—Jewell graphite controller: an adaptation of the author's controller, so arranged that the patient is placed in "shunt circuit."

also be used with a battery of cells. In both cases the current should be turned off with a switch when not in use, as a little current will otherwise flow through the shunt. The McIntosh Co. also manu-

facture an excellent shunt current-controller for these purposes (Fig. 90) which may also be used with a battery of cells.

Stationary Battery of Cells.—Where a battery of cells is required as a source of current, and it is to be used in the office or hospital building only, a stationary battery of permanent primary cells is essential. Such a battery consists of from 40 to 75 cells arranged in a series on shelves in a cabinet or convenient closet. By arrangement “in series” is meant that the zinc of the first cell should be connected by a wire or other connector with the carbon of the second cell, the zinc of the second with the carbon of the third, and so on. When

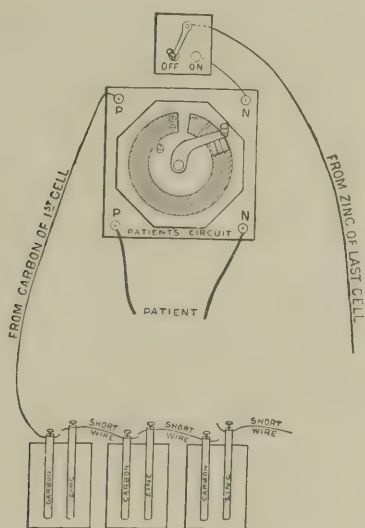


Fig. 91.—Arrangement of circuit for Jewell controller. It will be noticed that a current-breaking switch is placed in the main circuit. This should be off the button when not in use, to save slight cell-action. The meter should be inserted in the patient's circuit.

all the cells are thus connected it will be found that the carbon of the first cell and the zinc of the last one are free. A wire attached to this carbon will be the positive pole of the battery and another attached to the zinc will be the negative pole. The current from such a battery must be used through a controller and meter placed permanently and directly in series, as described for the incandescent cur-

rent. These wires, or "mains," may be carried throughout an institution, terminating in a pair of binding-posts on a wall-board, each binding-post being permanently marked with the proper polar sign, after due ascertainment of the identity of the pole.¹

The only cells worth considering for this purpose are the open-circuit bell-ringing cells easily procured from first-class hardware-stores in any part of the country now that electric bells are so common. These are all one or another variety of the Leclanche cell, consisting of carbon and zinc elements in a saturated solution of chloride of ammonium. These cells are said to be of the "open

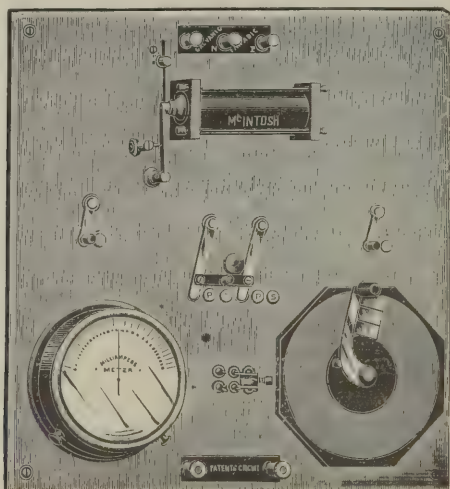


Fig. 92.—McIntosh switchboard for galvanic and faradic currents derived from Edison incandescent mains.

circuit" variety because they remain in good condition for long periods while unused, or with the circuit open. If used on a circuit of low resistance for many minutes at a time they tend, however, to run down by polarization, but will recover if allowed to rest. The variety now universally used is a simple carbon cylinder cell, the cylinder made in one piece with the cap, the zinc passing through an

¹ An additional pair of binding-posts is attached to another circuit in the author's sanatorium wall-boards for a current to operate the faradic coil.

insulated opening in the latter. In setting up these cells care should be observed not to permit the solution to wet the upper edge of the jars, as this would favor capillary "creeping" of the salts. The zincs should be cleaned at least once in six months, and if renewed at the end of a year or eighteen months will postpone a thorough overhauling for a much longer time when the battery receives but moderate use.

Portable Batteries.—Portable galvanic batteries are, at best, troublesome, yet indispensable when the patient must be treated in



Fig. 93.—Carbon cylinder cell. This form of cell has practically superseded all other forms of Leclanche cells.

her own home. An efficient source of electricity for use in gynecology is, however, only relatively portable, for they are much too heavy to be carried from house to house in a carriage, the most that can be done being to leave one with each patient,¹ for ease of portability is apt to be secured at a sacrifice of efficiency. Much attention has been directed, of late, to portable batteries consisting of chloride-

¹ In large cities a thirty-cell acid battery may be hired and recharged monthly at a moderate cost.

of-silver cells. Such batteries are a distinct luxury, as they may be carried in the carriage or hand with the utmost ease and are extremely convenient for a journey or visit in consultation, but one must not feel certain that they will do more than furnish a testing current for neurologic examinations or slight treatment. They are unfit for the heavy work of gynecology or general galvanic applications, and if found to be accidentally out of order are incapable of

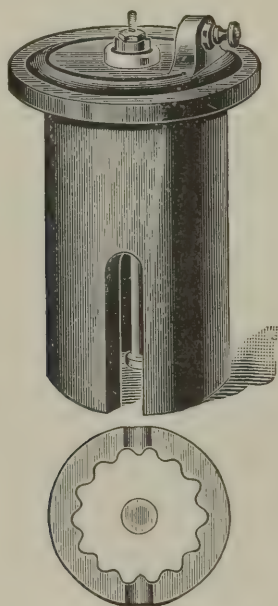


Fig. 94.—Elements of carbon cylinder cell.

repair by the user. The most reliable portable battery must still be the inconveniently-portable sulphochromate-acid batteries that are so liable to splash acid over carpet and carriage unless carefully handled, and that are sure to get out of order if not constantly used, for these batteries can be readily put in order by any electrician at slight expense, and no one should practice electro-therapeutics who cannot keep them in order himself if necessary. A thirty-cell battery of this kind can be depended on to furnish from fifty to seventy-five milliamperes for a daily application for two weeks with one charge of solu-

tion, at the expiration of which time a change of solution will make it as good as new again. The chloride-of-silver dry-cell battery would be quite unequal to such a proper requirement. Some of the portable dry-cell batteries of other makes which at first sight would seem to be useful, owing to the relatively large size of the elements, claim an efficiency limit of but 15 milliampères.

The original cell of the type used in the acid batteries is known

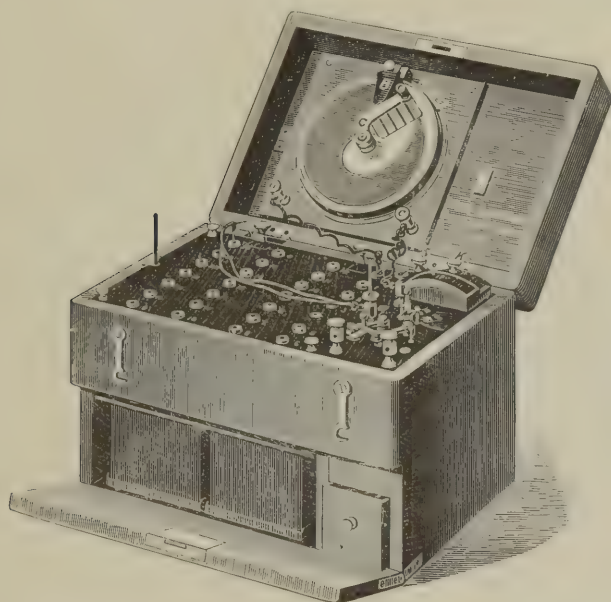


Fig. 95.—Flemming portable galvanic battery with meter and controller attached.

as the Grenet cell, and consists of carbon and zinc elements immersed in a solution of bichromate of sodium and dilute sulphuric acid,—the electropoion solution. The internal resistance of this cell is very small and the chemic action intense; hence a large current-output results in the short periods of time in which it is proper to use it continuously. The essential feature of the cell is the provision for raising the zinc, or, in the complete batteries, both elements, out of the acid when not in use: a precaution that is necessary if we would

save the zincs from being consumed by "local action," or irregular electric action between the particles of pure zinc and the metallic impurities found in the commercial article. This local action is greatly minimized when the battery is in use and waste of material saved by coating the zinc with mercury, or "amalgamating" it. The mercury unites with the zinc with greater ease than with its impurities; hence a surface of pure zinc in mercurial solution coats this element, the mercurial coating remaining until the zinc is consumed.

For gynecic purposes the acid battery should possess either

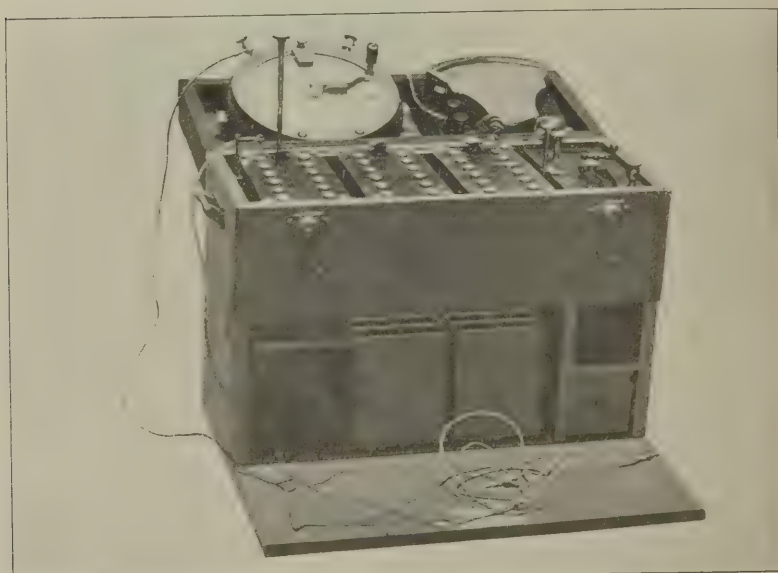


Fig. 96.—Insertion of meter and controller in circuit of ordinary portable galvanic battery. The cord from the first carbon is carried to meter and controller; that from the last zinc directly to patient.

twenty-four or thirty cells, giving a pressure of forty to fifty-five volts in accordance with the condition of the liquid, excellent examples being procurable from a number of manufacturers in this country, notably Flemming, of Philadelphia; Waite & Bartlett, Jerome Kidder, and Van Houten & Ten Broeck, of New York; and the McIntosh Co., of Chicago. There is but little choice between these

instruments, for none are usually supplied with controllers. In such case a meter and controller should be inserted into circuit when in use (Fig. 96), the terminals of the battery being treated exactly as the incandescent terminals described above.

This omission has recently been supplied by Otto Flemming in the battery shown in Fig. 95, which represents a portable acid battery of twenty-four cells with controller and meter attached, thus embodying an instrument of great utility and convenience and but moderate weight, owing to the cells being constructed of hard rubber.

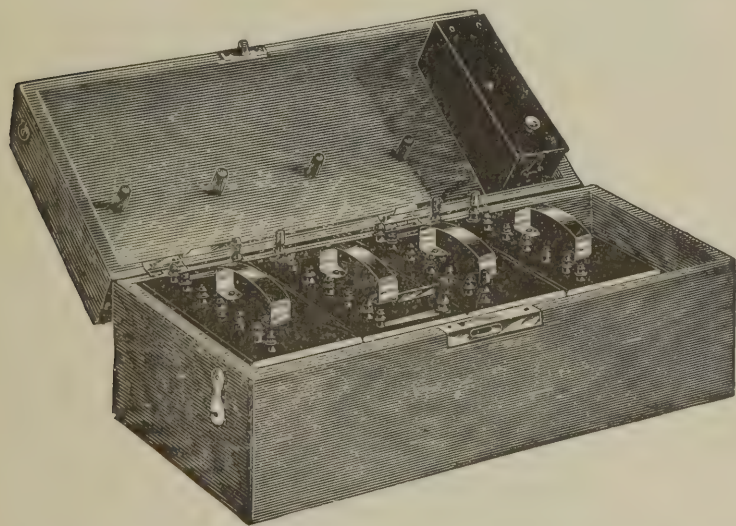


Fig. 97.—McIntosh twenty-four-cell portable galvanic battery. This battery is one of the simplest and most convenient of its kind. The elements, in sets of six, are immersed by simply lifting the section from the drip-cup and lowering it into the cells at its side, the connector being then lowered until it engages in a cleft in the next contiguous set. All danger of accidental interruption of the current, as when the cells themselves are movable, is thus obviated. The box is set into the lid in such a manner as to prevent the latter being closed unless the elements are put back into their drip-cups, thus conserving the zincs.

The special value and convenience of the recently-devised trans-portable battery of the author (Fig. 65) is by no means limited to the treatment of cancer. The large size of its cells and the other

mechanical improvements render it of unusual value in all gynecic work.

Care and Maintenance of Portable Galvanic Batteries.—When

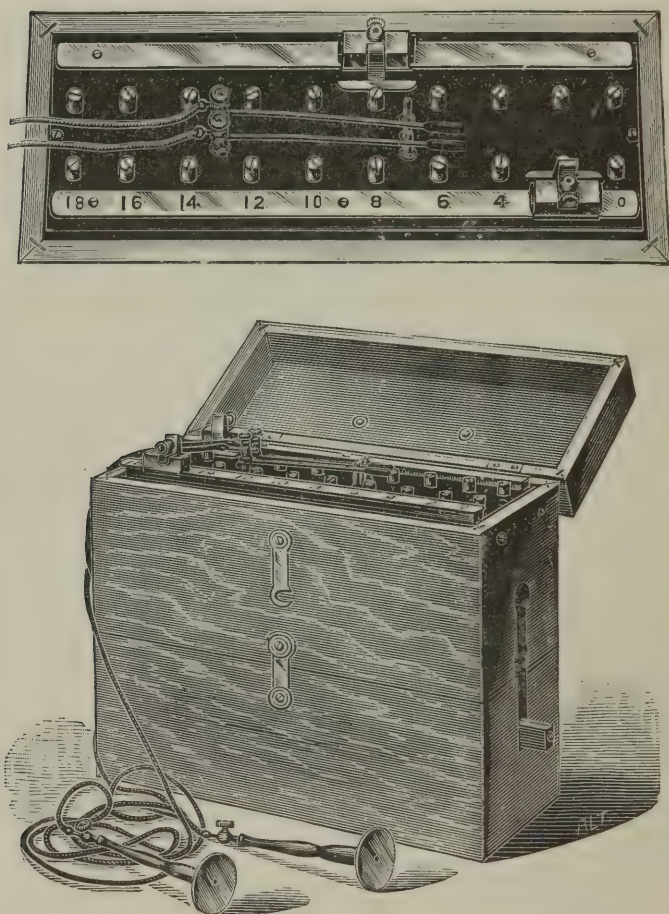


Fig. 98.—The Kidder portable galvanic battery, showing top plate and elements. The cells are raised in place when in use.

laid aside for any considerable time the cells of these batteries are best emptied and kept outside the case, or the case itself kept open. When about to be used the zincs should all be carefully amalgamated

with mercury, which is best done by dipping them into an amalgamating solution, or, in its absence, in battery-fluid, after which the mercury should be rubbed into their surfaces until they are thickly coated with this metal. Previous soaking of the elements in hot water will help to clean the zincs and will be useful in cleansing the pores of the carbons. Unless the carbons are clean and the zincs brightly amalgamated the battery-action will be very unsatisfactory and the zincs irregularly and uselessly consumed.

The fluid, or electropoion solution, used in these batteries should be made of bichromate of sodium and not of the potassic salt, as the latter is liable to split both the carbons and the cells by a heavy deposit of chrome-alum crystals. An excellent formula is: 1 pound of bichromate of sodium, 1 ounce of bisulphate of mercury, to 1 gallon of water; mix in earthenware vessel and set aside to cool before using. The bisulphate of mercury will tend to maintain the amalgamation of the zincs.

The cells should be lowered away from the elements immediately after the termination of the application.

APPLYING-MECHANISM.

The essentials for applying a galvanic current, whether derived from a portable or stationary battery of cells or from an incandescent circuit, are a controller and meter and the necessary conducting-cords and electrodes, together with certain switches and binding-posts for greater convenience. These are usually assembled on a switch-board or cabinet, but may be used by simply connecting the separate parts together, as shown in Fig. 86.

The Current-controller.—The purpose of this instrument is the regulation of a current to suit the case under treatment, permitting the desired number of milliampères to be turned on without shock after the electrodes have been placed in position, and similarly turned off at the termination of the application. The author's graphite controller was first designed and termed a "current-controller" in 1887, since which time the aptness of the designation has caused it to be applied to the governors of trolley-cars and other industrial users of current of various kinds. Until it was improved by the adoption of the shunt principle it was the most convenient and only practical instrument for the direct control of currents from a fraction of a mil-

liampère to three hundred milliamperes without waste of current, and should be used for the regulation of all ordinary medical galvanic currents, no matter what their source. It also controls the faradic and sinusoidal currents with equal facility, and where combination batteries or cabinets are used all currents should be made to traverse it before reaching the patient in order that all risk of shock may be eliminated.

In principle of action this controller (Fig. 100) depends on the

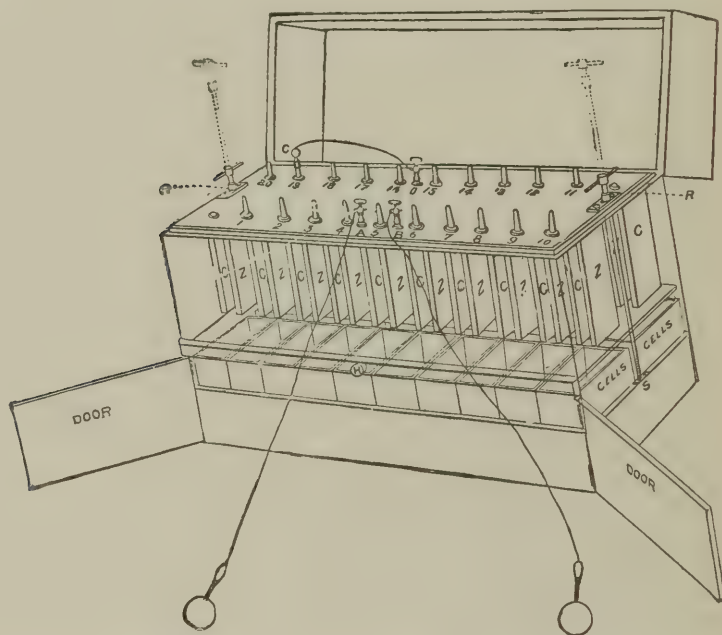


Fig. 99.—Skeleton drawing of Waite & Bartlett thirty-cell galvanic battery.

interpolation into the circuit of the variable resistance of a tapering area of graphite rubbed on a ground porcelain surface from an ordinary lead-pencil, the base of the area being nickel-plated and connected permanently with the metallic circuit. Over this area a radially-pivoted contact moves, the pivoted end being also permanently connected with the metallic circuit. When this spring touches the point of the area a slight current flows from metal to metal

through the poorly-conducting graphite layer, the current increasing gradually as the area included between the two metals becomes less, until finally, when the spring passes on to the nickel-plated base, all the current the battery is capable of is turned on, or, at any rate, all resistance of the controller is cut out. The instrument is not designed to measure the current, but merely to govern it, the milliamperè-meter, which should be invariably in the same circuit, indicating the number of milliamperès actually passing through the apparatus and patient at any moment. The point of the area is often too thickly

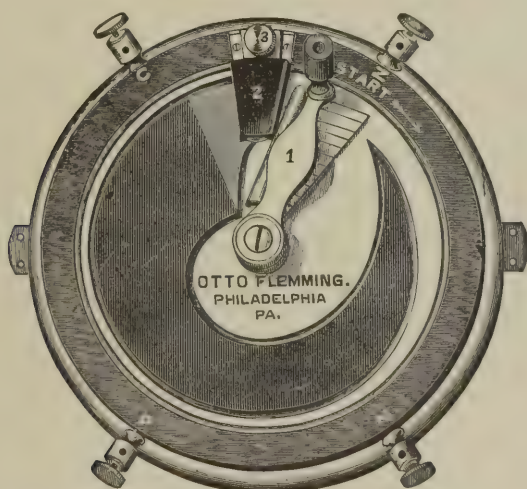


Fig. 100.—Massey current-controller. In this original form the patient is in direct series with the main-line of current.

coated with pencil-mark when the instrument is new, and should be slightly rubbed off, and the material should be kept particularly heavy at its junction with the nickel to avoid a slight jump in the current when it is desirable to turn the full force of the battery on. After a time the graphite becomes worn in places, requiring renewal by merely rubbing a soft pencil over it, preferably the BBB Faber pencil.

There are two conditions in which the improved Massey controller (Fig. 89) is superior to the older form, and that is when we

wish to give a weak current from a large number of cells, or a very strong current from either cells or incandescent mains; in both of these instances the shunt principle gives a gradation with least discomfort.

The current-controller has entirely superseded various clumsy and shock-producing devices known as current-selectors, which, except when employed as a two- or three- point switch in conjunction with the controller for occasional use of a less number of cells than the whole, or in controlling the very heavy currents of cancer, are now obsolete and deserving of special description only in works devoted to the history of electro-therapeutics. Water-rheostats are almost equally objectionable, being clumsy, unstable, incapable of sufficiently quick movement for many applications, and always leaving a small amount of resistance in the circuit. The use of the controller with the incandescent current has already been referred to (page 291).

The Meter.—This instrument is also indispensable to the physician, who has no more right to subject a patient to the influence of an unmeasured current of electricity than has a pharmacist to fill a prescription with unweighed or unmeasured drugs. The number of cells employed is incapable of giving definite knowledge, owing to the varied resistance of the skin in different individuals.

Without entering into details as to the construction of these instruments, for which the reader is referred to rudimentary treatises, it is sufficient to say that until the construction of the Weston ammeter in 1889 the industrial users of electricity as well as physicians were dependent on meters constructed on the principle of the deflection of a compass needle by a current. These are all liable to alteration and deterioration, seriously affecting their value after various periods of use, and are, moreover, affected by neighboring masses of iron or steel. The Weston meter is constructed on a different principle, the mutual induction of coils, and is now accepted both at home and abroad as a standard of correct measurement. Through the suggestion of Dr. Wellington Adams, who has produced a most valuable treatise on the physics of electrotherapy, the Weston company has placed a medical milliammeter on the market (Fig. 101) which leaves nothing to be desired. It has two scales, the upper reading from 0 to 500 milliamperes and the lower from 0 to 10 in tenths, the scales being unusually large and readable. It is also so constructed that the lower, or red, scale may be used as a volt-

meter for the measurement of an electromotive force below one hundred volts when it is in circuit with the resistances contained in a small box accompanying it. To measure the voltage of a battery or cell below ten volts the zero-marked binding-post of the resistance-box is connected with one binding-screw on the instrument and another wire is carried from the cells to be measured to the resistance-box post, marked 1000; the reading of the lower scale will then indicate the volts and tenths of volts when the circuit has been properly closed from the opposite pole of the tested cells to the meter. To measure the voltage of a whole battery (of one hundred volts or less) the same connections are made, except that the wire is changed to the binding-screw of resistance-box marked 10,000 ohms, these

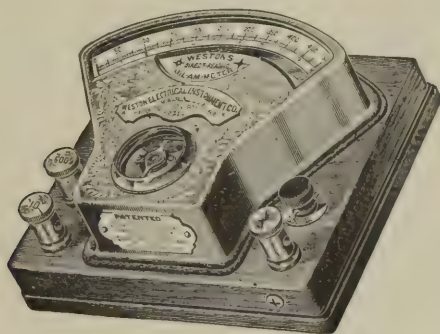


Fig. 101.—Weston milliammeter, arranged specially for medical work. There are two scales, the upper measuring to 500 milliamperes in divisions of 5 milliamperes, for which the negative wire should be attached to the binding-post marked 500; and the lower scale, measuring to 10 milliamperes in divisions of $\frac{1}{10}$, for which the negative wire should be placed in binding-post marked 10. The positive wire is always placed in post with plus-mark.

readings being also on the lower, or red, scale and each division normally representing the tenth of a millampère now reading a volt. The binding-post on the meter marked with a + sign should be connected with the carbon wire of the tested battery as in the ordinary use of the instrument as a milliammeter. The convenience of having an instrument capable of testing the voltage of cells and batteries that may be imperfect or needing repair, without extra cost, will be greatly appreciated by physicians.

The value of this type of meter has been so uniformly demonstrated by the exhaustive tests annually conducted by the Committee on Meters of the American Electro-Therapeutic Association that a number of manufacturers, notably the Edison Manufacturing Co., Otto Flemming, and the McIntosh Co., have constructed meters on a similar principle.

All meters of this type have one binding-screw marked for the positive pole and are, therefore, not adapted for a reversal of the current through their mechanism. The commutator, or pole-changer, of a switch-board should, therefore, be intercalated in the circuit between the meter and the patient, rendering reversal easy, without disturbing the course of the current through the meter.

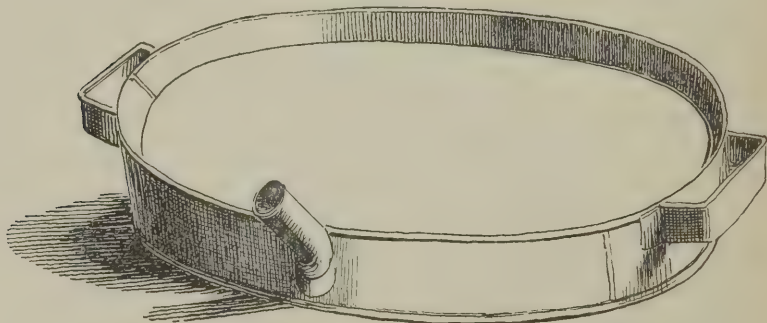


Fig. 102.—Jacketed pan for clay pads. Hot water is poured into the interior through the pipe shown.

Electrodes.—Electrodes for percutaneous and permucous applications of galvanic currents consist of an active and a dispersing electrode or pole, under the modern practice of considering the polarity rather than the direction of the current. The active electrodes vary in nature and form for each special application and are, therefore, fully described in the portion of this work relating to special affections and particular procedures.

The purpose of an application being usually the concentration of the current in or through a certain organ or set of organs with as little unpleasant sensations or actions elsewhere as possible, the rôle of the indifferent electrode is not only the mere completion of

the circuit, but it should render the current-effect at this point as inactive as possible. This is done by increasing the surface of contact and by making the moist conducting-joint (page 31) between the metal and the subdermic tissues as perfect as possible. It was the application of this principle in the construction of the abdominal clay pad by Apostoli that gave the present impetus to the use of strong currents in gynecology, as already noted.

The Apostoli Clay Pad.—The clay for this purpose should be

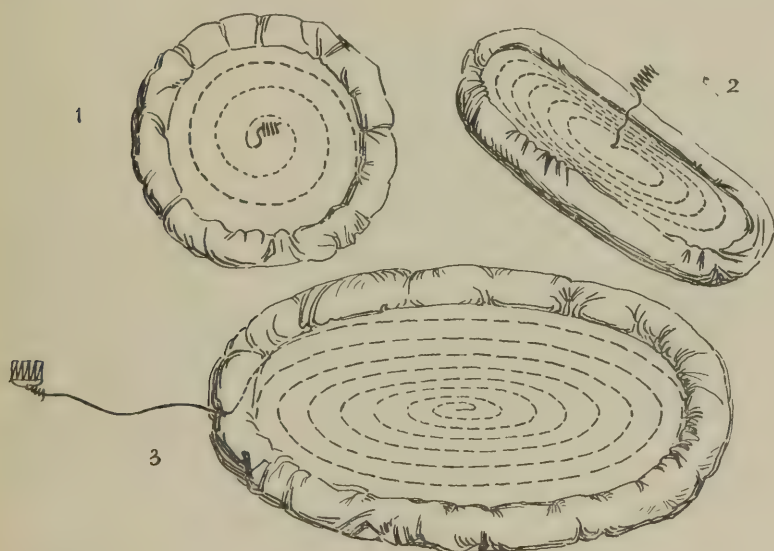


Fig. 103.—Author's wired cotton electrode pads. 1, abdominal pad, for general use. 2, spinal pad. 3, large dispersing pad.

of the variety used by potters, and should be kept in the consistence of soft mud by admixture with water in a covered crock. The pad should be made freshly for each application, or each morning when used daily, and is most comfortable to the patient when heated in a jacketed pan (Fig. 102) in the space between the double bottom and sides of which boiling water has been poured. Before putting the clay into the pan two layers of mosquito netting or a single layer of tarlatan should be spread out over the bottom, the material being

large enough to reach beyond the edge of the pan to enable the clay to be lifted out after the pad is made by grasping its ends. The pad should be about an inch thick and of a sufficient size to cover the abdomen of the patient. After lowering it on the abdominal surface a block-tin or lead plate supplied with a binding-post or socket for attachment of the cord is pressed down upon it. This plate is best shaped like a four-leaved clover and should be nearly as large as the pad.

Ready-made clay pads are poor affairs compared with a pad so

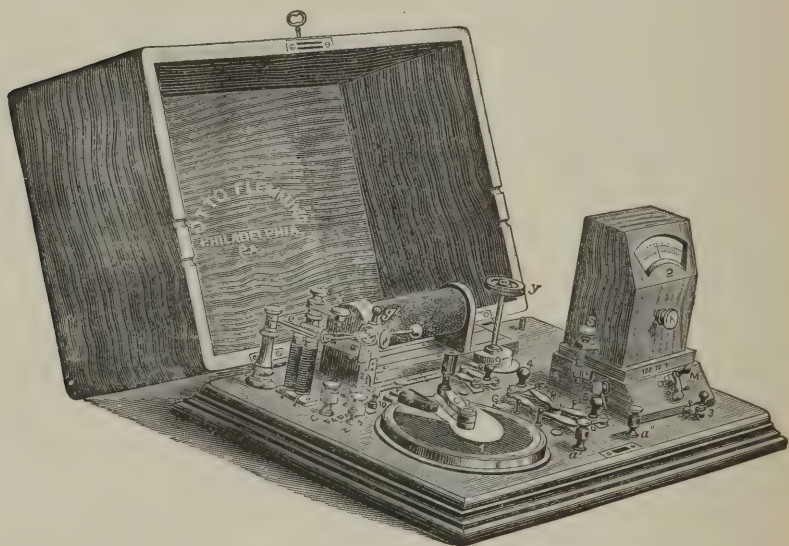


Fig. 104.—Author's complete switchboard arrangement for both currents.

made and less useful than the cotton pads next to be described, which have displaced all forms of clay pads in the great majority of the author's applications.

The Author's Wired-Cotton Pads.—The most convenient pads for a dispersing electrode to be used on any part of the body are the author's wired-cotton pads (Fig. 103), which are made in two or more sizes as follows: In the centre of a piece of muslin somewhat larger than the intended pad the end of a spool of No. 20 soft, brass wire is sewn. The wire is then coiled in an increasing spiral and securely

sewn in place on the muslin, each spiral being about half an inch from the preceding one, until the desired size is obtained, the shape being oval for the large pad and round for the smaller. When it has attained dimensions of about 7 x 11 inches for the larger and 6 inches for the smaller, a small turn is made in the wire and sewn down to prevent pulling out, and a considerable length of wire is left for connection with the battery. This free end should be at one end of the spiral for the large pad and in the centre of the small one. Six or eight layers of absorbent cotton should now be cut to shape and piled on the wired side, and on top of the cotton a piece of muslin is placed to be folded over and sewn to the edge of the back of the pad. The pad should now be quilted lightly through and through to keep the cotton from packing, and when the end of the wire left free is made into a spiral friction-socket for connection with a battery-tip by winding it about the end of the tip, the electrode is complete.

Such pads are easily made by an intelligent nurse. They are wet with hot water and freely soaped with ivory soap on the contact-surface farthest from the wire when used. Before each subsequent use with a new patient they should be boiled for a few minutes.

The smaller one of these pads is most conveniently used as an active electrode in general applications (page 53) or as an indifferent pad for small currents.

Office Switch-boards.—Fig. 104 illustrates an exceedingly convenient and complete switch-board for office use or an institution that is wired from a permanent battery of cells. It may be attached to a portable table with a cable-conductor of four wires for connection with wall-boards in each room. Current for galvanic treatment and for operating the faradic coil is thus conveniently obtained in any part of the house from powerful and reliable stationary batteries of cells in a cell-closet. The current from the galvanic battery is thus easily controlled at the bedside. To operate the faradic coil at such a distance requires about six chloride-of-ammonium cells arranged two abreast in a series of three, and the wire should be of moderately large size.

CHAPTER XXIV.

EXPERIMENTAL HANDLING OF GALVANIC CURRENTS.

No ONE should apply an electric current to a patient without having previously familiarized himself somewhat with its practical management; and it is best for the beginner to emphasize the lessons thus gained by a moderate demonstration of the sensory effects on his person. With the battery set up or put in operation, the meter and controller being in circuit, the small electrode discs and cords may be attached to the binding-posts for the following experiments:

To Test for Current. (Experiment 2).—Set the controller for least current (in the graphite controller with the crank on the beginning of the pencil-mark to the right of the rubber bridge), and bring the brass parts of the electrodes together. The meter will show a deflection of more or less milliamperes. If there is no deflection a break exists in some part of the circuit.

To Test the Power of the Battery and the Range of the Controller. (Experiment 3).—Unite the poles directly by means of a conducting-cord or wire, and note the gradual increase in the current as the crank is moved toward the broader graphite. This procedure is wasteful of battery power, but will show the total capacity of the battery through these resistances, if the meter registers high enough. With the incandescent current the increase should not be above the capacity of the meter.

To Test the Polarity of the Electrodes. (Experiment 4).—If in doubt as to which is the negative pole and which the positive pole of a galvanic battery or pair of incandescent terminals, place the tips of the cords in a solution of potassium iodide. The compound will be electrolyzed, iodine appearing at the positive pole as a brownish cloud, and potassium at the negative pole. If the potassium iodide be dissolved in starch-water, the discoloration at the positive pole is blue instead of brown, the nascent iodine immediately uniting with the starch. A more quickly performed test than this is to ascertain which tip gives off the greatest amount of gas when immersed in

simple or saline water, the negative possessing this distinction on account of the hydrogen-gas given off at its surface being double the volume of oxygen at the positive. The negative pole also gives the most sensation when suddenly brought in contact with a sensitive part of the hand.

Comparison of Metallic Contact with Moist Cotton to Cotton Conduction. (Experiment 5).—*Having set the controller for a weak current*, note the number of milliamperes in circuit when the brass surfaces of the two electrodes are brought together, and the number when the two wet surfaces of cotton or sponge are pressed together.

This will show the immensely greater conductivity of brass. As the current is not intended to go right back to the battery in this manner during ordinary work, it is called "short circuiting," and is wasteful of the battery power and dangerous to the delicacy of the meter.

Application of Dry Metallic Electrodes to Skin Compared with that of Wet Electrodes. (Experiment 6).—Experiment now with the dry metallic surfaces of the little electrodes pressed down upon dry skin surfaces. Little or no current will be shown by the meter if the skin is free from moisture, even with the controller set for full strength. Substitute wet cotton-covered electrodes for the dry ones, and a current will be shown both by the sensations and the meter.

The current passes with exceeding ease from metal to metal when in contact, either dry or wet; but passes from dry metal to the body with difficulty. This is because the cuticle is practically a non-conductor; not until the air-spaces of its horny layers are filled with water, which is a reasonably good conductor, will it permit the current to penetrate to the moister tissues below, and even then the bulk of the current passes through the sweat-ducts and any congested or abraded spots. Electrode coverings are therefore designed merely to hold a layer of water between the metallic surface and the skin, acting as a conducting-joint.

In making the experiment just detailed with dry metallic points instead of a flat surface, an intense burning sensation will soon develop if the full number of cells are used and the points well pressed down. This burning coincides with the appearance of some current in the circuit, as shown by the meter; but the number of milliamperes by no means corresponds with the intensity of the burning; very little current passes, in fact, when the pain is greatest. This

pain of the "galvanic brush" is usually described as due to the concentrated action of the minute current-quantities upon the most superficial and sensitive nerve-filaments; but doubtless the real reason is the microscopic spark leaps through the cuticle incident to this mode of current-transmission.

Effect Produced on the Current-volume by Salt Water on the Electrodes. (Experiment 7).—Set the controller at a given place and leave it there (or use the full strength of a certain number of cells), and note the number of milliampères passing through the hand when both wet electrodes are pressed upon opposite sides; leaving the battery-strength undisturbed, remove the electrodes and saturate them with salt water. When they are replaced, a considerable increase in the number of milliampères passing through the hand will be found. The sensations will be still more acutely increased.

Saturated salt water is about three thousand times a better conductor than distilled water; hence the use of salted water on electrodes increases the current by lessening the resistance offered by the conducting-joint at the points of entrance into and egress from the body. It is of great service when the battery-power is deficient or accidentally low; but its constant use is inadvisable, owing to the disproportionate increase of pain produced by it and the bad effect upon the electrodes, which are quickly oxidized. The excess of pain is doubtless due to the irritant effects of the products of the decomposed chloride of sodium.

Effect upon the Current of Different-Sized Electrodes. (Experiment 8).—Note the number of milliampères passing through a part of the body from the full strength of fifteen cells,—(1) when two small electrodes are used; (2) when two medium ones are used; (3) when two large ones are used,—care being observed to place them in the same spots and press their whole surface in contact.

If it is more convenient to use all the cells in the way advised generally in this work, instead of using the full strength of only fifteen, it may be done by simply setting the controller for a comfortable current with the small electrodes, and leaving it untouched in the subsequent steps of the experiment.

The increase of current when the larger electrodes are used is exceedingly striking. The cuticle, as has been explained, is the chief obstacle to the current; and from a given number of cells but a certain quantity can be forced through each square inch of its surface.

The more square inches are included in the conducting surface, therefore, the more current will go through from the given number of cells; but there will be no increase in (and possibly a slight diminution of) the number of milliamperes passing through the original square inch of skin, unless the number of cells is increased or the resistance of the controller lessened. The use of broad electrodes is indicated, therefore, whenever we wish to introduce a large current into the body with a minimum of pain and without a special concentration at the points of entry. It is the only way to affect deep structures by percutaneous transmission without excessive pain, and for such purposes both electrodes are large. In gynecic work, where the effect of a single "active" pole is alone desired, the other "indifferent" pole is made sufficiently large to secure easy penetration without such local action.

Comparison of the Effect of the Same Current-strength when Concentrated and Diffused. (Experiment 9).—Connect the body with the positive pole of the battery by means of a large moistened electrode on its surface. This will form the indifferent pole. Select (1) an equally large moistened electrode for the active pole; place it on another part of the body; connect it with the negative terminal of the battery, and bring the current up to, say, eight milliamperes, as shown in the meter. Note the slight pain produced. (2) Exchange the large active pole for a medium-sized one, moistened of course, and bring the current up to the eight milliamperes. The pain will be increased, owing to the concentrated action of the same number of milliamperes. (3) Use next a fine point as active pole, well covered with moist cotton, and again bring up the current to eight milliamperes. The pain is quite decided.

As the size of the active pole is diminished, the current being kept the same by adjusting the controller, there is an increase in the intensity of the pain corresponding to the increased density at this spot. The indifferent pole is left large in this experiment, as in so many gynecic applications, because it combines a slight resistance to the current with the least local pain. The experiment illustrates admirably the axiom that more force is required to get the same-sized current through a small place than through a large one,—a principle that applies self-evidently to most things.

Increase of pain accompanies with great certainty an increasing concentration of a given number of milliamperes on the skin surface:

but it should not be forgotten that this is because of the peculiar sensibility with which the body-sheath is endowed. Beneath it and in the interior of less sensitive cavities there is no such admonition to guide us; hence the use of a meter becomes more imperative in the latter situations, for the current is just as active whether pain is felt or not. It is only at and near the junction of mucous membrane with the skin surface, such as the lips, vulva, etc., that great sensitiveness to currents exists; and here it is even more sensitive than on the skin surface, in accordance with a fuller endowment of sensitive nerve-filaments.

Differing Resistances of Skin Surfaces. (Experiment 10).—

The differences in the resistance offered by the skin of various parts of the body, and of different persons, is readily shown by the effect on the meter at each position, the battery and controller being left undisturbed. The face, inner surface of the limbs, etc., will show more current (presenting less resistance); while the back and outer surfaces of the limbs will show less current (presenting more resistance), etc.

That these differences depend almost entirely on varying thicknesses of cuticle is proven by the showing of more current with the poles on distant but thin spots than when alongside of each other on thicker cuticle. The difference between corresponding parts of the skin of different individuals is also at times considerable, especially when a clear-skinned blonde and pallid brunette are compared.

Comparison of the Resistance of Skin and Mucous Membrane. (Experiment 11).—Connect but a small number of cells, say fifteen, with the meter and controller, in order that the full strength of that number of cells may be used. Having put the indifferent pole on the abdomen or back, cover an insulated-stemmed vaginal electrode with absorbent cotton, wet it, and direct the subject of the experiment to hold it between the bare arm and chest in such a manner that the whole conducting surface is in contact, as it would be in the vagina. Turn the current on gradually now to its full extent by means of the controller, and note the number of milliampères. Reverse the controller until there is no current, and introduce the electrode into the vagina. The current may then be again increased by the controller to its full capacity, and the number of milliampères noted in this situation.

A marked increase in the milliampères will be noted in the

vagino-abdominal circuit over the merely percutaneous one, on account of the lessened resistance encountered at the active pole when placed in contact with mucous membrane.

Alteration of Nerve-irritability Within each Polar Region. (Experiment 12).—Attach two medium-sized electrodes of the same dimensions to the binding-posts, place them (well wetted) on the skin over each peroneal nerve just back of the head of the fibula, and increase the current to five or ten milliamperes.

The burning pain under the negative electrode is in distinct contrast to the numb sensation under the positive.

The Effect on Nerves of a Slowly Varied or Continuous Current Compared with that of a Sudden Current-variation. (Experiment 13).—Proceed as in Experiment 12, noting that no pain or motion is produced in the distant parts of the nerve if the five or ten milliamperes have been attained by a *gradual* increase from zero. With the current at this height remove now one of the electrodes and reapply it (or break and make the circuit by an interrupter),—a contraction will be produced in the muscles supplied by the motor fibres, and a sudden sensation in the areas supplied by the sensory fibres of the nerves.

The actual performance of these and similar experiments is unequaled in its teaching power. Besides familiarizing one with many details essential to successful work with the continuous current,—such as the necessity of always using a meter; the possibility of avoiding shock, even with powerful currents; the advantage of ample battery-force held in easy check by a controller; and the wisdom of using large and small electrodes as we wish non-local or local effects,—it will show that the practice of electro-therapeutics, while relieved of many unnecessary and obsolete theories, may still remain free from the formidable task still imposed by some recent writers, who recommend that the resistance of the tissues be calculated and recorded in each case. As well might they say that we should measure the darkness in a room rather than the light produced in the effort to dispel it; in the one case the photometer and in the other the milliamperemeter are all-sufficient to convey full information for practical purposes.

CHAPTER XXV.

THE FARADIC CURRENT.

Mode in which Faradic Currents are Produced.—Faradic currents are isolated rises of pressure in a wire, produced at the moment of breaking or making the galvanic current of a cell which circulates in its immediate neighborhood. This current is named after Michael Faraday, who first discovered that a current would be so produced in a closed-wire circuit placed over or close to another in which a galvanic current was varied. The strength of the current so produced is proportional to the strength of the producing current, plus the length of the wire subjected to the influence of the inducing current-circuit; so that convenience necessitates the coiling of one insulated wire about the other, producing a solenoid, or induction coil, in which many feet of wire occupy but a small space. It is necessary that the two wires, carrying the inducing and induced currents, should be close to each other and properly insulated throughout. The action of the inducing current from the cell in the first coil is increased if a soft iron core be inserted within it, making what is called an electro-magnet.

In a simple coil of but few turns, or in two straight wires placed close to each other, a current arises in one direction in the second wire on closing the cell-circuit in the first, and another current arises in the other direction on opening the cell-circuit. The current that appears in the secondary coil at opening the cell-circuit in the primary is direct, or in the same direction as the cell-current, while the current that appears in the secondary at the moment of closing the cell-circuit is inverse. The primitive faradic current is, in other words, a to-and-fro, or alternating, current. In the batteries we use this is also true of the currents from the secondary coil, though, for reasons to be shown, only the direct currents are therapeutically important. An equal electromotive force and an equal volume arise in each direction, causing an equal amount of electrolysis (which is thus continuously neutralized), yet the therapeutic effects are very dif-

ferent on account of the greater abruptness of potential rise in the direct current; and as the only purpose for which faradic currents are used in medicine is the muscle- and nerve- stimulation or sedation that a minute current can produce when very suddenly developed, the secondary current of opening is practically the only one used.¹

A faradic battery (Fig. 105) consists essentially of one or more galvanic cells placed in circuit with a primary insulated wire surrounding the core, and with an automatic device to alternately break and make the cell-current. Over the primary coil is slipped a bobbin

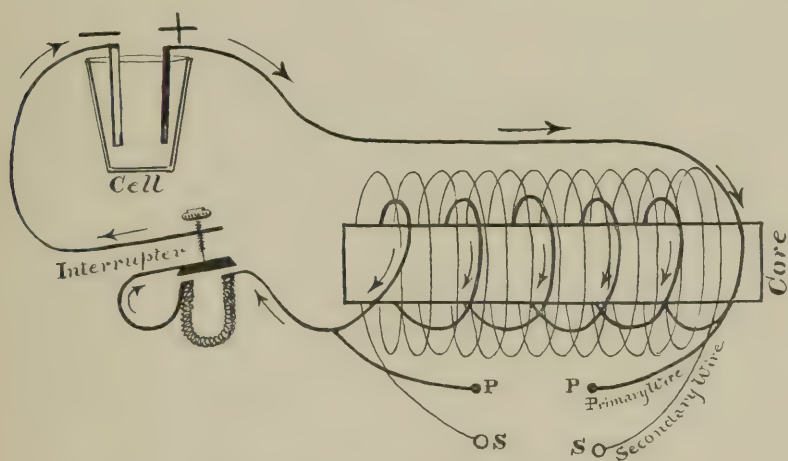


Fig. 105.—Diagram of faradic battery.

having another coil of insulated wire wound about it. This second, or secondary, coil has no metallic connection with the cell or the cell-current, deriving its current by induction because of being placed over and close to the primary coil and core. The operation of the apparatus is as follows:—

The cell-current, proceeding from the carbon pole of the cell, traverses the primary coil and returns to the cell through the interrupter, the platinum points of the latter being in contact. In the

¹ The direct current of opening is formed and completed in 0.000275 second, while the inverse current of closure took 0.000485 second.

act of traversing the coil this current makes the core magnetic, which in turn attracts the small armature on the interrupter, breaking the cell-current; the magnetism of the core having now disappeared, the spring returns to contact, when the whole process is repeated. The rapidity of this automatic action depends on many factors that will be referred to later. At the instant of closure of the cell-current a reverse induction arises in the secondary coil, but this rises slowly on account of what is called self-induction between contiguous windings of the primary coil. At the instant of opening the cell-current a direct current arises in the secondary coil of much sharper curve of ascent (because there is but little self-induction to interfere with it). But no currents arise in the secondary coil unless its ends are closed by a patient or other conductor at *S S*.

Recurring to the primary coil, it will be noticed, by reference to the figure, that the patient, when connected by electrodes with the primary binding-posts *P P*, is placed in what is known as a "shunt," or parallel circuit with the primary coil. This permits an infinitesimal amount of the cell-current to traverse the tissues when the spring is in contact; but since the resistance of the coil is less than an ohm and that of the patient some hundreds of ohms it will be seen that practically all of the cell-current will take the short road through the cell instead of going through the patient. At the moment of closure of the cell-current a reverse current does arise in the primary coil by self-induction, but this never reaches the patient, being expended, as already stated, in blunting the sharpness of rise of pressure in the cell-current at closure. When the cell-current is opened at the interrupter, however, the primary direct induction arising in the primary coil has no recourse but to traverse the patient placed in connection with the binding-posts at *P P*. This induced current of opening, known among electricians as an "extra current," is the medical primary current, and gets much of its force from the demagnetization of the core; and, since it is produced in a coil nearer the core than any secondary wire can be, the volume of the current may be greater, other factors remaining the same. The direct inductions only can reach the patient, the inverse inductions being neutralized by the cell-current. *The primary current is, therefore, not in any sense an alternating current.*

Means of Controlling Faradic Currents.—In the sledge or du Bois-Reymond apparatus, which is the one found in the best gynecic

apparatus and in the large cabinets, and is decidedly the best form, the secondary coil is made to slide over the primary, the inductions in the secondary gradually strengthening as the secondary windings are more and more subjected to the influence of the cell-current in the primary coil and of the core. To slide the secondary slowly over the primary is, therefore, a method of turning the secondary current on, and to slide it off a method of turning it off. The reverse is true of the primary current, which is weakest when the secondary completely covers the primary, and is increased by uncovering it. The secondary coil thus acts as a damper on the primary,¹ abstracting the inductions to itself. An old form of Duchenne's apparatus provided for controlling the current by covering both coils with a tube, which, when a complete cylinder, dampened the inductions in both coils and core by permitting circular inductions around its own circumference. The cheaper portable apparatus of the present day accomplish the same regulation by a sliding cylinder covering the core only, but both methods of regulating with cylinders have the disadvantage of not reducing the currents to zero, leaving a slight shock when the circuit is closed with weakest current.

The most convenient method of regulating or controlling faradic currents is by setting the coils at the position for the greatest current of the kind required and then passing the current through the same controller employed with the galvanic current, which will be found to answer perfectly. This method is invariably followed by the author.

Though so-called faradometers have been both promised and constructed, there has been no way devised to measure faradic currents actually traversing the patient, owing to their slight volume and short duration. Arbitrary records of position of coils are employed for comparison, while therapeutic dosage is governed mainly by the effects obtained.

The Cell and Cell-current.—One red-acid or two chloride-of-ammonium cells are usually sufficient to operate the coils, a greater number being required at times with the long wire coils. The zincs should be kept in order and brightly amalgamated and the solution

¹The secondary coil would not have this damping effect on the primary were it not that an automatic arrangement closes its end for this purpose, making it practically a tube.

fresh, as the work of these cells is heavy, uniformity of interrupter action and full induction requiring that about half an ampère should circulate through the primary coil. Since the circuit is all metallic outside the cell, with an external resistance less than an ohm, one or two good cells will suffice.

The Primary Coil and Core.—The proper construction of faradic coils is just now the subject of much discussion in electro-therapeutic circles, a standing committee having been appointed by the American Electro-Therapeutic Association to conduct investigations, and while

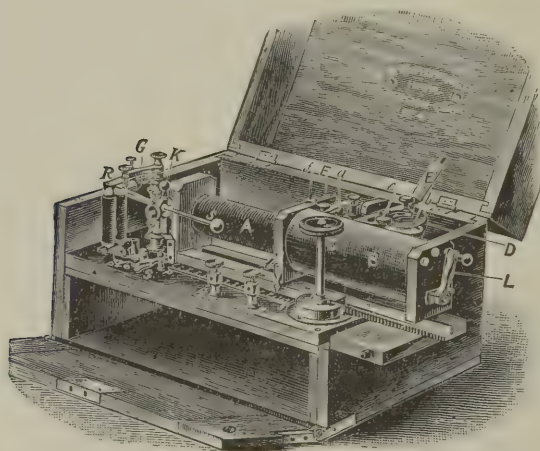


Fig. 106.—Flemming's No. 4 faradic battery, possessing a high-tension coil and excellent primary, controlled by the du Bois-Reymond slide.

it is beyond the scope of this work to enter into technical discussions that would be too voluminous for its pages, the growing importance of these currents in gynecology necessitates a succinct statement of the features that are at present thought to be essential in a properly-constructed gynecic apparatus. It is too true, as stated by Goelet and Engelmann, that the great majority of physicians have purchased, and are still purchasing, apparatus that is practically worthless for gynecic purposes. Even much of the best apparatus recommended by these authors has too small a primary coil and core to give a really powerful contracting primary current. The most useful size of pri-

mary coil, in the author's experience, is that usually found in the Flemming No. 4 faradic battery and his cabinet apparatus. The dimensions are: length of core, $5\frac{1}{2}$ inches; thickness of core, $\frac{3}{8}$ inch; the coil contains 120 feet of No. 18 copper wire, wound in four windings. The resistance of the coil is eight-tenths of an ohm. It is likely that these proportions are nearly correct, as no additional contracting power was gained in several experimental coils, either

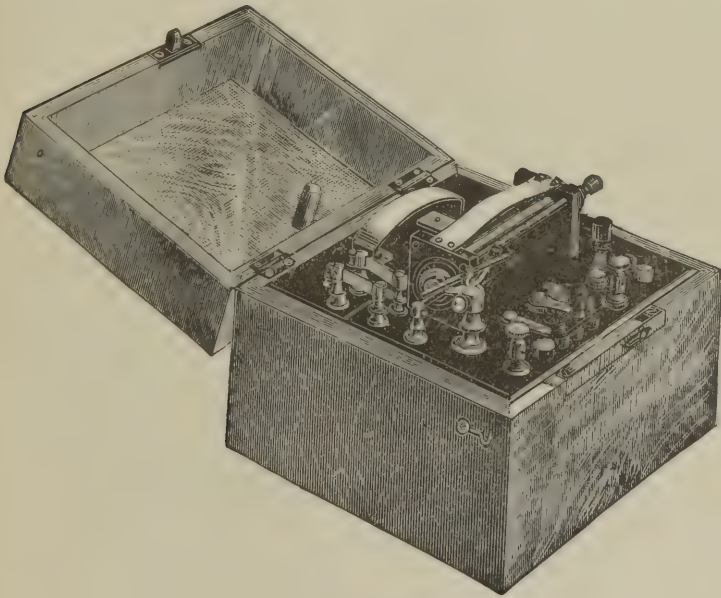


Fig. 107.—McIntosh faradic battery.

by doubling the length of core and coil or by changes in the size or length of the wire.

Primary Current.—Since the primary coil is made of a comparatively short thick wire, permitting of but few turns about the core, the electromotive force developed in it is not nearly so high as in the secondary coil. Its nearness to the core results in heavy ampèreage in comparison to the latter coil, however, which is rendered greater by the slight resistance of the short thick wire. In regulating it with the Massey controller the secondary coil is removed all the way, or

to the greatest extent desired, and the controller turned on until a sufficient contraction is obtained. Owing to the low pressure, it will be noted, no current is felt until the controller is half-turned on, but the current increases with augmented rapidity as the point of no resistance is reached. The converse is true with the high-pressure currents of the secondary coil, most care being required to make the increase gradual at the beginning of the graphite area.

Uses.—The primary current is indicated whenever we wish to produce fullest contractions of muscular tissue, whether striated or

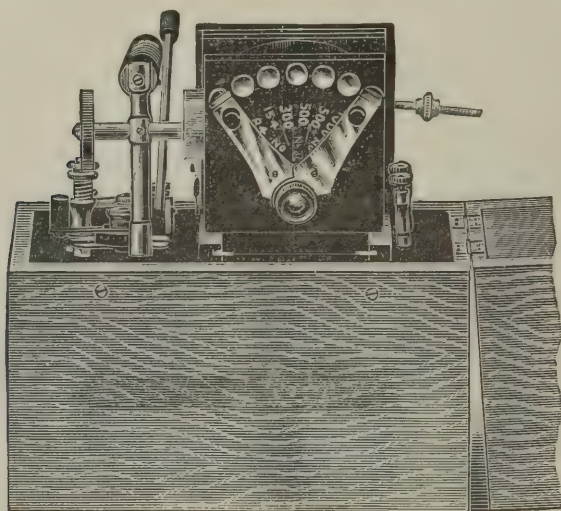


Fig. 108.—End-view of Rockwell's high-tension coil, as made by the Jerome Kidder Manufacturing Company.

unstriated, provided the total resistance of the circuit is not great. When applied through externally placed electrodes, therefore, we must use large well-moistened pads, and, if it be monopolar, the indifferent pad must be large. It is particularly adapted to bipolar work, owing to the small resistance between the electrode surfaces, and is indicated in recent subinvolution and in atonic conditions of the bowels and bladder.

The Secondary Coil and Current.—As already stated, the secondary coil must be made of a long fine wire if a considerable electro-

motive force (as yet not accurately measured) is to be developed for use in producing sensory and vascular sedation. Currents from very long wires are best for use in conditions of semi-acute irritation, when rapidly successive inductions of high pressure and extremely small volume only are bearable. As a condition of greater tolerance is established a more distinctly contractile current will give increased curative effects; hence an instrument for gynecic use should have several interchangeable secondary coils to choose from, the coil adapted to the case being slipped over the primary as required. The earliest effort in this direction in this country was the portable faradic

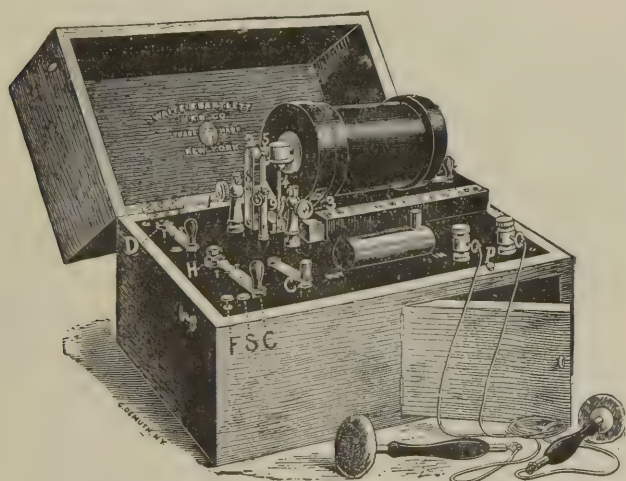


Fig. 109.—Engelmann's faradic battery.

apparatus of Dr. George J. Engelmann, formerly of St. Louis, in which three secondary coils were used.

The Engelmann Coils.—No. 1, coarse wire coil, is made of No. 16 wire, about 225 feet long. This is used for motor stimulation, though a good primary coil will do better work of a similar kind.

No. 2; intermediate coil. This is made of No. 21 wire, about 675 feet long, and produces less painful contractions.

No. 3; fine-wire coil. This is made of No. 31 wire, 1980 feet long, and the effect is moderately sedative.

The Goelet Coils.—Owing to the possibility of obtaining greater

sedation by a still longer wire in the fine coil, Dr. A. H. Goelet, of New York, has introduced a set of three coils of still greater elaboration, the two fine spools having switches on the end, permitting of the tapping and using of different lengths of wire from the same coil. They are constructed as follows:—

Coarse coil, No. 22 wire, 750 feet long.

Intermediate coil, No. 32 wire, 2400 feet long, tapped at 1600 feet and 900 feet.

Fine coil, No. 36 wire, 4500 feet long, taped at 3000 feet and 1500 feet.

The Goelet coils, when supplied with a properly-made primary coil and core, leave nothing to be desired in their adaptation to the most varied therapeutic indications.

The Interrupter, or Rheotome.—This is a most important part of a good gynecic apparatus and is unfortunately seldom what it should be. I am convinced that the simple vibrating spring-hammer of Neef, which is the kind usually found on even the best batteries, should be abandoned entirely in favor of what I have called the bow-string interrupter of Flemming, or else of the “singing rheotome” of the Galvano-Faradic Co. The bow-string interrupter is simply an extension of the spring to double its length, both ends being attached to posts, to one of which a tension-screw is attached to increase or lessen the tension of the spring and thus regulate the time of the vibrations. The armature is attached to the middle of the brass spring and the platinum plate for contact near the fixed post. Besides regulating the frequency and amplitude of the vibrations by the tension-screw, we regulate them also with the set-screw carrying the platinum contact-point. This device gives easily the rate of vibration suitable for muscular contraction, which is from 1 to about 3000 per minute, and this rate serves well for sensory sedation if the fine coils are used. According to d’Arsonval, the highest stimulation may be obtained from a suitable coil between 3000 and 4000 interruptions per minute, the stimulation decreasing with a further increase of the rate until with 7000 to 9000 interruptions of a medium current it is no longer felt. Vibrations above 3000 per minute are therefore sedative rather than stimulating, the separate excitations of muscle and nerve blending together, muscular excitation finally ceasing, and the sensory excitation changing into a numbness.

There is no really practical means of measuring the rate of

vibration of springs, however, the low or high note emitted by them being the most convenient method of approximate estimation. Regularity of rate, with consequent regularity of current-rise and fall, is particularly essential, not only in sedation with high-frequency currents but for painless contraction; hence a spring that gives a confused or jarring note should be discarded for one that can be adjusted and maintained to a clear note, whether low or high. With all springs,

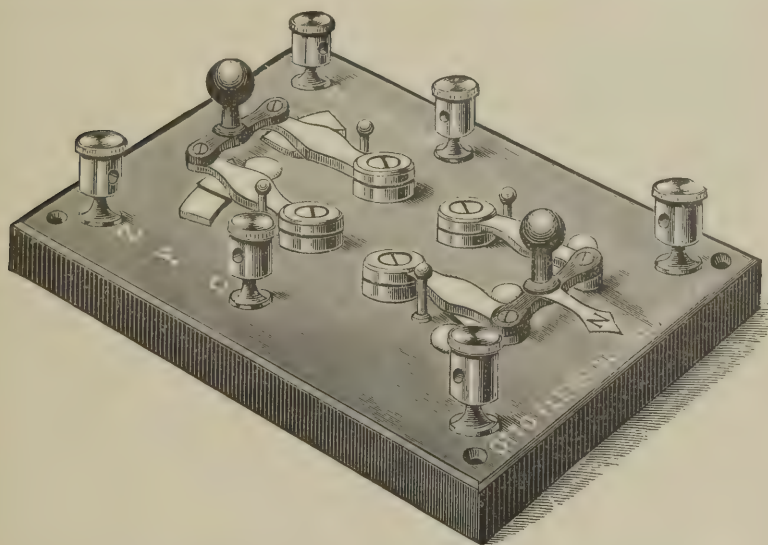


Fig. 110.—De Watteville combiner, to which is added a pole-changer, or commutator, with index pointing to the negative pole.

however, there seems to be an unfortunate liability to sudden changes when the relative position of the coils is changed during a *séance*.

To get rid of these disadvantages Engelmann has revived the wheel-interrupter, worked by an electric motor and easily capable of regulation and record of frequency. This apparatus gives promise of being highly useful, though I have, as yet, had no experience with it. Such a method of current-interruption enables us also to get a wider range of currents from the ordinary coils, since a one-way primary current may be obtained from any secondary coil by sending a sufficiently strong cell-current through it.¹

¹ See Medical News, February 3, 1894.

Polarity of the Faradic Current.—The primary current of a faradic coil has as distinct a polarity as the galvanic, being always in one direction, as explained above. The secondary currents have also a distinct polarity in their physiologic action, though not so marked as is the primary, the direct inductions being stronger and more abruptly produced than the inverse inductions. The electrode attached to the negative pole of either current will, therefore, be found to be the most stimulating when applied to nerves and muscles, and the positive most sedative.

Indications for the Use of Covered and Bare Electrodes with Faradic Currents.—The use of a moist conductor to convey the faradic current *through the skin* to nerves and muscles beneath it is fully as important as in the case of the galvanic current; for, although the former current leaps from a dry metallic disk to the skin with great facility, and is therefore best adapted to the dry-brush method of stimulation, it expends its action at such times almost entirely on the dermic surface and nerve-ends, the polar region being extremely superficial. The moist covering permits a greater penetration and extension of this region; hence, a deeper action with less surface pain. Within moist cavities, however, the use of a moistened covering on the exposed conducting surface of the electrode is totally unnecessary, as the moisture of the cavity itself readily favors this distribution of the current. The bare electrode is, moreover, introduced into such cavities with greater ease. The handles of such electrodes should, of course, be properly insulated, to protect the vulva and other parts not designed to be affected.

Experimental Comparison of the Electromotive Force, or "Pressure," of the Faradic Current with that of the Galvanic Current. (Experiment 14).—This may be roughly done by touching simultaneously, with dry fingers, the bare terminal wires of a full-strength galvanic battery. No current is felt, since the sixty to ninety volts of pressure in such a galvanic current are not sufficient to make the current jump through the minute layer of air between the finger and the wire; moist fingers permit a little to get through. If, now, the dry fingers be simultaneously brought in contact with the bare terminals of a faradic current of merely medium strength considerable tingling will result; its pressure is amply sufficient to cause it to leap through this air-space.

There are two practical applications of this fact besides its dem-

onstration of the main quality of electromotive pressure: one indicates the need of a more careful insulation of the faradic current to prevent accidental shocks; and the other, the greater adaptability of this current for the electric-brush application to the body-surface.

Action of the Faradic Current on Sensory Nerves and Muscles.

—Notwithstanding the exceeding weakness of this current in “bulk” or “volume,” the great requisite for usefulness in the mechanic arts and in the chemic destruction and metamorphosis of tissue, a slight acquaintance with its action on any part of the body is apt to impart an exaggerated idea of its physiologic powers. Being essentially a series of exceedingly abrupt current-creations, its power to excite the functions of nerves and muscles is unique, and the manifest phenomena of pain and muscular contraction conceal its total inability to produce profounder impressions on the body. A nerve or muscle, brought within either polar region, is thrown into action as each induction arises, just as an abrupt variation of the galvanic current, whether a rise or fall, produces a similar phenomenon. Each induction produces a separate stimulus, therefore, and it is only when they follow each other very rapidly, as when a rapid interrupter is used, that the separate stimulations seem to blend together, producing a continuous contraction or sensation. Even then the impressions on the nerve are those of distinctly-separated, though rapidly-successive, currents. The sedative effect produced by high-frequency currents from the fine coil is probably of the nature of a temporary anesthesia of the terminal sensory apparatus.

The faradic susceptibility of the sensory nerves of the limbs and trunk is fully shared by those of the pelvis, although the lessened sensibility of the normal uterine and ovarian nerves permits the employment of current-strengths not bearable on the skin surface. The vulva, on the contrary, like other muco-epidermic junctions, is exquisitely sensitive to this stimulus, and should be protected from it in all ordinary applications by well-insulated electrode stems. The sensibility of the vagina is about midway between the two.

Therapeutic Uses.—This current acts only on nerves and muscles, stimulating each into action or developing anesthetic effects, and its use is, therefore, limited strictly to such conditions as exhibit nervous or muscular laxity or pain. But is this limitation a very narrow one? How many of the commoner cases met in daily practice present just these shortcomings, especially those encountered in

a public clinic? The case after case of displaced and prolapsed uteri that present themselves, with or without rectocele or vesicocoele, and with intact perinei, teach the paramount importance of muscular tone of the vaginal walls and uterine ligaments in the maintenance of a normal condition. When this tone has been lost, it is evidently the part of rational medicine to endeavor to restore it, if possible,—not to prolong and intensify it by erecting a false skeleton with a pessary or tampon within the vagina.

Properly constructed bipolar electrodes are peculiarly efficient in attaining this contractile action on relaxed pelvic muscles, inclusive of the uterus itself. Bipolar vaginal applications may be with the coarse-wire coil or primary current if there is no inflammatory conditions present, but in the latter case the pain and violent contractions produced by these currents are capable of increasing the mischief. The combination of mild contractile and anesthetic effects obtained from a similar use of fine-wire currents is, on the contrary, most beneficial, even in subacute inflammation; hence bipolar fine-wire currents are useful in a large number of cases, the simple anesthetic effects rendering them invaluable in either inflammatory or non-inflammatory neuralgias.

Electrodes and Dosage.—As a rule, the active electrodes required for galvanic applications may be used for this current, and a similar dispersion of current at the indifferent pole is advisable when used after the monopolar method. The absorbent-cotton pad will, of course, be more convenient than the clay if a faradic current only is to be used.

The only electrodes peculiar to the faradic current, and which should not be used with other currents, are the bipolar electrodes, of which the one for use within the vagina is the most commonly employed. Apostoli's bipolar vaginal electrode as modified by Goelet (Fig. 22) is decidedly the best. In this instrument the designer has adopted the bulbous projections suggested by me to make better contact with the mucous membrane, and has also altered the relative proportions in such a way that the instrument is practically self-sustaining within the vagina.

Apostoli's intra-uterine bipolar electrode (Fig. 27) remains the best in design, but all intra-uterine bipolar electrodes are clumsy and difficult to thoroughly asepticize.

The selection of the dose is purely empirical, as we have, at

present, no means to measure this current beyond the individual scale of each instrument. The best guide to the strength required in a given case is gained from the sensations of the patient, the current having been brought up from zero to the point of easy tolerance, after placing the electrodes in position, in the same gradual manner as advised for galvanic applications. If we do not shock by a sudden turning on or off, there is no possible way in which the patient can be harmed; so that our main point in muscular applications is to use as much current as the patient will bear, and it is astonishing how much can be given in this way with one pole in the vagina or uterus and a large dispersion on the abdomen. Weaker currents are better for neuralgic conditions, as a rule. The milliamperemeter is, of course, useless with this current.

CHAPTER XXVI.

FRANKLINIC, OR STATIC, ELECTRICITY.

Physics.—The electricity produced by static machines is of exceedingly high pressure (53,000 volts per centimetre of spark-length, according to Lord Kelvin) and very slight volume (five-thousandths of a milliampère to a quarter-inch spark, according to Sprague), though the volume per spark-length really varies with the number of plates in the machine. With a current possessing such an infinitesimal volume it will be seen that the principal therapeutic effects are due to an inconceivably high polarization of nerve and muscle. When the spark is applied to the dry body it undoubtedly disrupts the cuticle on its way to the moist tissues that act as the surface of the conductor, the surface nerves of sensation receiving the brunt of the excitation; but if moist electrodes be employed, as first suggested by Morton, the spark is conveyed through the skin by conduction rather than disruption and deeper nerves and muscles are then readily reached, as with other currents. Since the volume of these currents is so slight, it is, of course, essential that an interruption of the current, or sparking space, must exist somewhere in the circuit with the patient for any action to be manifest, the completely closed external circuit giving us a galvanic, or continuous, current of only five-thousandths of a milliampère,¹ which is practically nothing.

There is, however, another important physical effect produced by this form of electricity besides the polarization of nerve and muscle by transmitted currents. This is the static effect of the charge on the body-surface when sparks are not used. The equally-diffused charge as in static electrization, and particularly the concentrated charge on the portion of the body opposite the electrode administering

¹This calculation of the milliampèrage of franklinic currents was made from old machines, and is doubtless much greater with the many-plate machines now used.

a spray, have peculiar and yet but imperfectly explained actions on surface-nerves and tissues.

For a full explanation of the principles involved in the operation of a static, or influence, machine the reader is referred to more comprehensive works on electro-physics. The machine may be described in brief as similar in operation to a dynamo, a minute charge given to a paper-element inducing a reciprocal charge on the nearest portion of a revolving plate, which, by rapid revolution and reaction effects, multiplies the charge to a full load.

The paper elements on the stationary plates of the main machine are analogous to the field-magnets of the dynamo and the revolving plates to the armature. The medical influence machines now made on a large scale in America are merely an improvement of the Holtz pattern, in which the principle of induction was substituted for friction about 1865, the improvements consisting in multiplying the plates, protection from atmospheric influences, and perfecting the mechanical features. The revolving plates are plain discs of glass, coated with shellac, which permit of the greatest development of an initial charge, though it has been found that the Wimshurst improvement is superior in the development of this initial charge, though inferior in its multiplication. The most perfect apparatus now consists of two separate machines, placed in the same cabinet, but preferably in separate compartments, the Wimshurst machine being merely used as a charger when the main battery has lost its charge. Analogous combinations are frequently found in dynamo-houses.

Selection and Care of the Static Machine.—The author has frequently been asked if a static machine is a necessary adjunct to an office outfit in the practice of neuro-gynecology. Though skeptical originally on this point himself, a long experience has convinced him that it is of far more relative importance than a faradic outfit, though still far beneath the galvanic apparatus in relative value. Comparisons are of but little moment in such matters, however, the indications for the use of each current being usually distinct and separable. No office is thoroughly equipped for good work without all three of these currents.

In the selection of a machine it should be understood that the electromotive force of the current is determined by the diameter of the revolving plates and its volume by the number of these plates. Now, a most important form of treatment in neurasthenia and allied

conditions is the static spray and static charge, and, while adequate sparks may be applied from machines of but moderate size, these two procedures demand that the machines shall possess at least six revolving plates, which shall be at least thirty inches in diameter. These

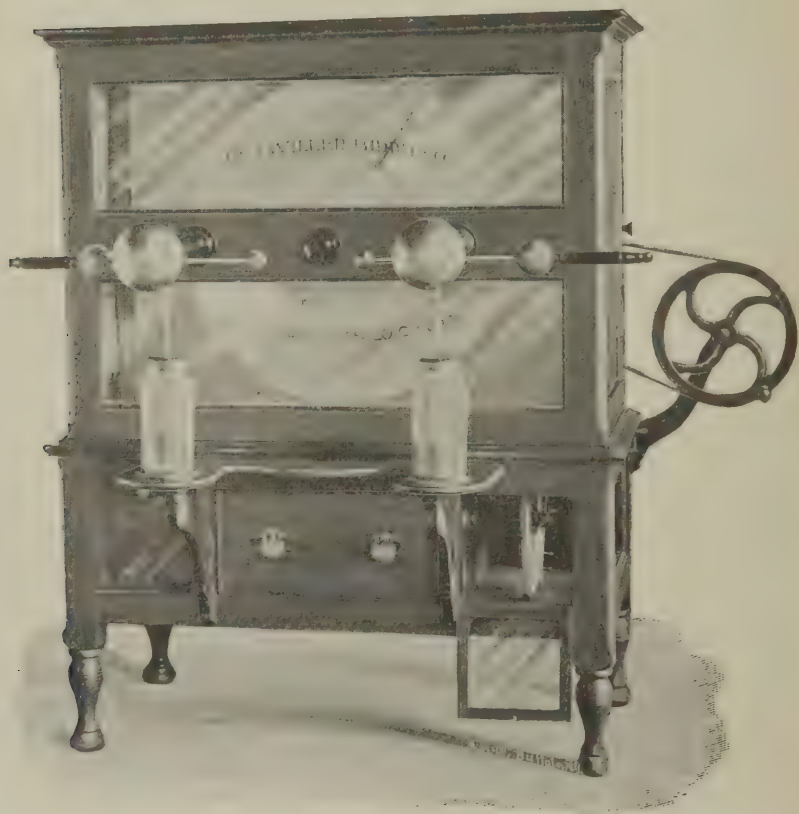


Fig. 111.—The Massey improved Wimshurst-Holtz static machine.

details are really as important as the number and efficiency of the cells of a galvanic battery.

Secondly, it should be remembered that these generators of electricity consume nothing but the power required to turn them, the current being developed by the motion of parts composed of specially

adapted materials under narrowly defined conditions of dryness and cleanliness. It follows that too much skill cannot be expended in the purely mechanical parts of the machine to insure proper wear under the necessary motion, and that the user should exercise reasonable care in maintaining the proper adjustment of the stationary plates to prevent harmful friction between the several parts, proper adjustment of the belt, and the dryest attainable air-space within the case. This latter is best maintained by several dishes of the anhydrous chloride of calcium, which should be heated to dryness when deliquescent.

A most important reason for the selection of the largest and best static machine for therapeutic work is that this otherwise useful apparatus forms also a most valuable means of developing the x-rays of Roentgen with but slight additional expense for the tube and fluoroscope, thus rendering a special coil unnecessary for this purpose.

The large machines now produced in America are far superior to any of foreign make that the author has used, but some of them are still in the transition stages of mechanical development. Messrs. Detwiller, Biddle & Co., of New York City, have recently placed on the market a Holtz machine combining all the most desirable features of these machines with such additional improvements as my own experience has suggested (Fig. 111). It works without disappointment in all conditions of weather and gives at least double the output of current of any other machine of equal size. The x-ray effect produced by it when a tube of sufficient size and highness of vacuum is attached is magnificent, defining the deeper portions of the trunk in a hitherto-unsurpassed manner. To prevent leakage all edges and corners of the case have been rounded and the usual brass screw heads that project from the case have been eliminated. The charger is a modified Wimshurst, simpler than formerly made, and more reliable and rapid in charging. It is placed in the base of the cabinet, which separates it from the corroding effect of the ozone generated by the machine proper, and economizes the space occupied in the office. The shaft of the large revolving plates is composed of one piece of rolled steel, insulated entirely by a polished hard-rubber sleeve, enhancing the appearance and preventing sparking inside the case. This shaft runs in specially-made ball-bearings, which are noiseless, and which reduce the friction to a minimum. Case-hardened steel cones, which are adjustable, take up all the wear and all end-motion, and prevent shifting or rubbing of the plates. A speed of four hundred revolu-

tions per minute—necessary for the best x-ray work—can be safely maintained. Besides a number of other improvements of an electro-technical character, a feature of great importance is the simple and ready means of replacing any part broken by accident. All parts are supplied by the manufacturers in duplicate and may be put in place by the physician without difficulty. To one living at a distance this point is of importance.

The accessories furnished with this handsome machine are shown in Fig. 112, the electrodes being made of aluminum, securing lightness and non-corrodibility.

The machine can be easily driven by hand or by an electric or water-motor of one-sixth horse-power.

Methods of Application.—In all applications the patient sits or stands on an insulated platform (which should be elevated from the floor by solid glass legs), and the platform or projecting portions of clothing should not be closer than two feet from the machine-case or other furniture, to prevent leakage.

Much confusion has resulted from various directions given by writers as to the proper method of connecting the patient with the machine, a recent author of a very ambitious work devoted to this current alone specifying that one pole should always be grounded by connection with a water-pipe or gas-fixture, and pictures elaborate wiring of his office for this purpose. He even goes further than this, and specifies at least two simultaneous “groundings” of opposite poles at times; but where he gets the other earth for a connection does not appear, though a different set of pipes communicating with the same cellar-floor seems to be meant. The way out of this sorry confusion is to remember that the current from this machine obeys laws exactly similar to those of all other electric currents; and, while it may take the circuitous route through the cellar, a better one is the direct metal route *via* the chains and rods back to the other pole. It is impossible to increase the efficiency of a machine during any direct method of treatment (*e.g.*, the spray or sparks) by including pipes, the earth, etc., in the circuit, the whole current being produced by the machine tearing apart the ether within itself. What has been mistakenly regarded as a ground is the direct electrization of the walls of the room surrounding the static machine by connecting the opposite pole to it during the first procedure to be described,—the static charge,—which is weak unless the walls of the room are made a condenser by

direct connection with the opposite pole; and this is best done by attaching the chain to a good metallic reservoir, such as a pipe, imbedded within it. With this exception, all methods of application

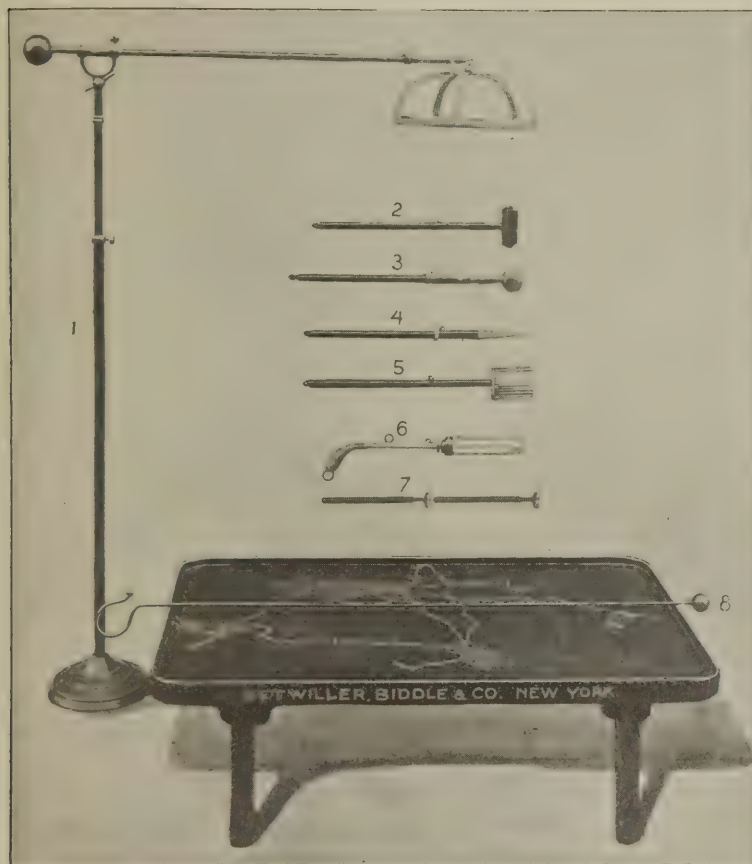


Fig. 112.—Electrodes for use with static machine, with platform for patient, the latter being insulated twelve inches by solid glass legs. 1, aluminized telescoping standard, with aluminum ball and point electrodes for stationary treatment with spark and spray and for support of umbrella for head-breeze. 2, aluminum hand-massage roller electrode. 3, aluminum hand ball electrode for applying sparks. 4, aluminum hand point electrode for applying spray. 5, aluminum hand brush electrode for applying movable breeze. 6, aluminum and glass director electrode for internal application of sparks or spray. 7, hand sponge electrodes for Morton's induced current. 8, shepherd's crook, and chains for connecting platform or patient with prime conductor of machine and electrode.

are exactly analogous to the method of a "dispersing" and an "active" electrode, though I frequently moderate the spark treatment by interposing a longer or shorter floor-space in the circuit. This is done by dropping an end of the chain from the active prime conductor to the floor; near it rests the end of another chain connected with the active electrode, thus forming a rude, though effective, controller. It should always be remembered, however, that when even the carpet is thus put into one of the circuits from prime conductor to patient that we get a condenser effect, due to charging the room, and this is accentuated when we charge metal masses in its walls. The best method of reducing the strength of a spark application to suit a timid or weak patient is to have the machine turned very slowly and press the ball-electrode close to the skin, the sparks being then only of a length equal to the thickness of the clothing.

It should be stated here that the Leyden jars, or condensers, are very rarely to be used in the spark applications, and never any other than the smaller one when employing machines of many plates, as the effect on any part of the body not profoundly anesthetic is terrific. They are not to be used at any time during a spray application. When not used in the shunt-controller application of the Morton static induced currents they are best out of the way on top of the machine-case.

Before taking any spray treatment about the head ladies should invariably remove any metallic articles, such as hair-pins, etc., as otherwise the spray effect is spoiled by slight sparking between these objects and the scalp. They should also remove the corsets and replace the outer garments, or else don a woolen sac, before taking a spark or spray application to the body.

Clothing formed of good dielectric material, such as wool and silk, intensify the effects.

(a.) *The Static Charge*.—The patient is seated in a cane-bottomed chair placed on the insulated platform and holds in the bare hand a chain or rod connected with the pole selected, the rods having been widely separated. From the other pole a chain is carried to a neighboring gas-fixtured or water-pipe, in order that the whole room may receive the charge from this pole. When the machine is put in operation the patient will be highly charged with the polarity with which she is connected by the chain in her hand, the effects being greater if she be connected with the positive pole. A good speed



PLATE XXII.—Application of Head-spray.



PLATE XXIII.—Application of Direct Sparks by Roller Electrode.

of the machine is required. The current escapes from the patient at all points and angles, the charge being maintained by rapid revolution of the plates. A peculiar sensation is produced, and in many persons free perspiration results. Considerable emphasis is laid upon the physiologic and therapeutic effects of this application by some writers. It is distinctly sedative.

(b) *The Electric Spray*.—With the patient in the position just described and holding the chain attached to the positive pole, an electrode having one or more sharp points is connected with the negative rod and held at a distance of from six inches to a foot from various parts of the body-surface, whether covered with clothing or not. The point is electrified negatively and communicates its charge to the adjacent air-particles; the latter are attracted to the nearest portion of the body-surface, giving rise to a discharge by convection, in the shape of a continuous, slightly-luminous spray of electrified air. If the current is weak, there is a distinctly cooling sensation, the effects of the actual wind predominating; but a really-effective spray soon produces a pricking and feebly-burning sensation, particularly at the roots of the hair and other points of special discharge. The application may be carried over all parts of the body, or may be localized at a painful spot for some minutes by attaching the point of a Cleaves combination stand resting on a glass or rubber plate placed on the floor.

The spray is weaker when the active electrode is connected with the positive pole.

The head-spray (Plate XXII), which is extremely useful in all conditions of cerebraesthesia, is given in the same way, a head-piece bearing many points being connected with the negative pole and suspended about six inches above the head. This method is a general tonic and cerebro-spinal derivative, and is useful in conditions of nervous prostration, insomnia, hysteria, and neuralgias of mild degree. It should precede the more vigorous treatment by sparks in very nervous persons. An intermediate method between the spray and sparks is obtained by using a wooden electrode, which permits a more vigorous spray to be directed against a part.

(c) *Sparks*.—With the insulated patient holding a chain in the bare hand attached to one pole, a roller electrode is attached to the other pole by means of a chain and is passed swiftly over the surface of the woolen or silk clothing (Plate XXIII). The sparks that pass are

but the thickness of the clothing in length and are very numerous. With an efficient machine this form of sparks is usually too strong for most persons, and it may be further tempered for sensitive cases by interposing the resistance of the floor, a third chain or rod passing from the operator's pole to the floor on which the end of the chain attached to the electrode also rests at some distance (Plate XXIV). To increase the effect of the sparks the electrode is held at the distance of an inch or more from the clothing. The nature of the outer clothing exerts an influence over all forms of these applications, a moist surface, or a cotton or linen one, taking the current to itself rather than permitting a proper penetration to the body. A good insulating outer garb is essential, preferably of rough woolen material.

The mild sparks are a general stimulating tonic, and specially useful in the backache of nervous persons, the severe sparks being useful also in anesthetic conditions. The Leyden-jar condensers are not used except in profound anesthesia.

(d) *The Franklinic Induced Current*.—Dr. Morton, of New York, has introduced a method of making percutaneous or permucous applications of what is known as the franklinic induced current in which both electrodes are applied to the body with moist coverings, as in faradic or galvanic currents. It should, of course, be understood that a sparking space must exist somewhere in the circuit, and in this case it is in the metallic circuit rather than at the surface of the body. Very short sparks only are bearable, in the neighborhood of a line in length. Better results are obtained if the condensers are used, giving additional ampèrage.

Fig. 113 shows the connections, the smallest-sized Leyden jar being usually employed and the electrodes are put in position with the rods touching before the machine is started, the right-hand rod being then screwed apart slightly from its fellow. The pressure of the current is determined by the distance between the balls. This current is an alternating one, reciprocal sparks passing through the patient between the external coatings of the condensers contemporaneously with the sparks between the balls. It is said to be more effective at times than the faradic current, but is more troublesome to manage, the cords and electrode handles requiring to be specially constructed with high insulation. A better control may be exercised over this current by placing the patient in shunt with a Cleaves static controller.

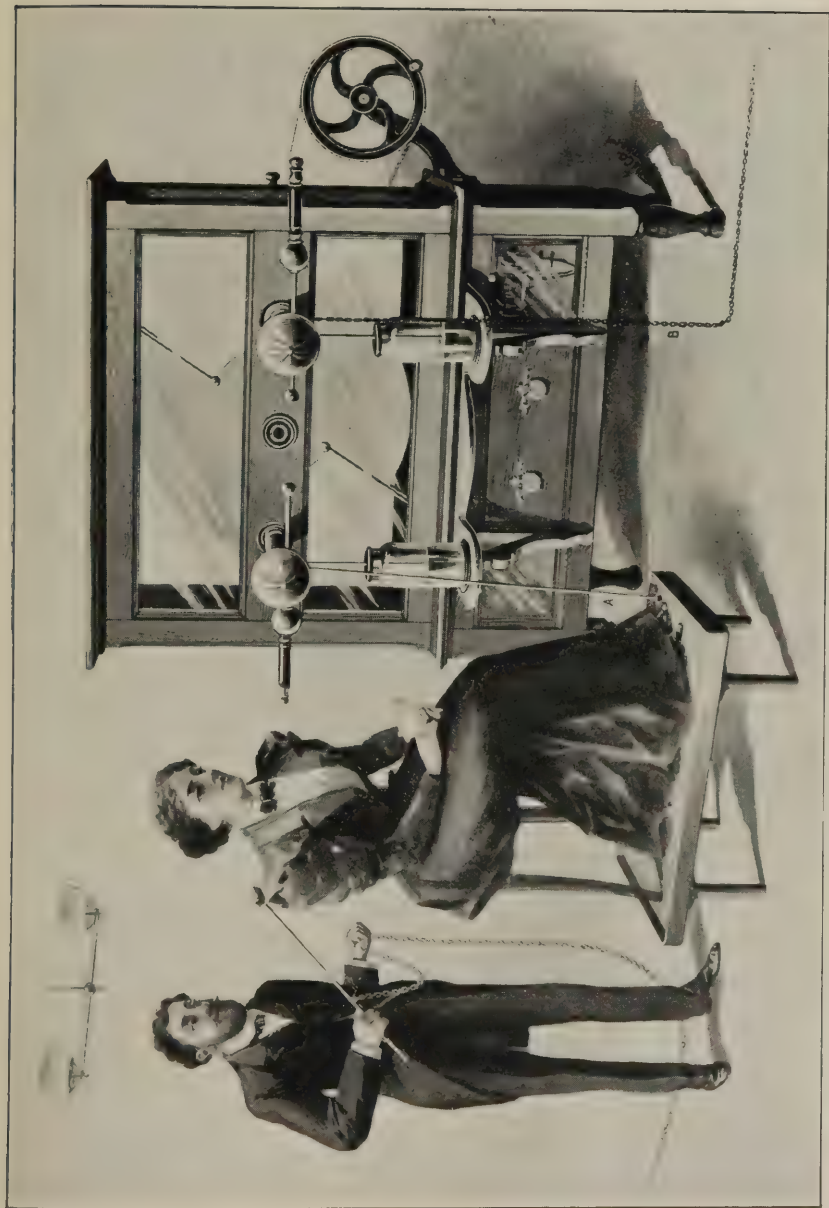


PLATE XXIV.—Indirect Sparks (condensers should be removed).

(c) *Ozone Administration*.—The passage of these high-pressure currents through the air results in the production of considerable quantities of ozone from the aerial oxygen, easily detected by the peculiar odor or by its turning paper a blue color that has been moistened with a solution of potassium iodide. It can be administered from a small electrode with a number of points which is held a few inches from the mouth and nostrils of the patient, who is seated on the insulating platform connected with the opposite pole.

After Using the Machine.—To maintain the charge all chains should be removed from the prime conductors immediately after use and the rods left separated.

Therapeutic Uses in Gynecology.—In adaptability to the needs

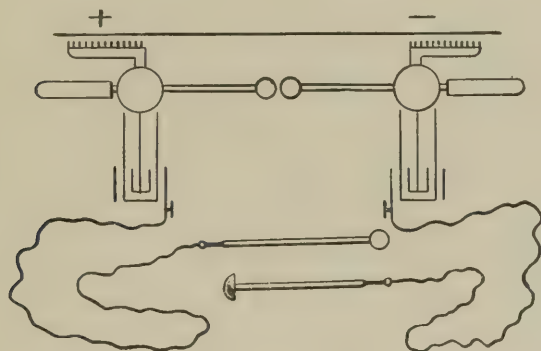


Fig. 113.—Arrangement of circuit for Morton's static induced current.

of the gynecologist the static current depends for usefulness on his recognition of the neural relationships of many affections apparently arising in the sexual organs, as well as on the purely neural character of much of his work, for its value in chronic sciatica, insomnia, chronic rheumatism, and various neuroses is very great. An important fact first noted clearly by Apostoli is that the strong spark treatment enables us to discriminate between hysteria and neurasthenia. In hysteria the patient is capable of receiving a truly enormous voltage in the shape of sparks, with but little sign of feeling them. This is because hysterical analgesia is so common in these cases, and it may be noted that under the stronger sparks the hys-

terical cases improve until finally the sparks give as much pain as normally produced. In neurasthenia no such tolerance of the spark treatment is ever found, this form of application being usually so stimulating as to be wisely replaced by the spray. Among the cases favorably affected by this current those of neurotic backache stand pre-eminent, and, in fact, some form of static treatment may well be conjoined with pelvic applications of other currents if this symptom be prominent in connection with organic pelvic disease. For mere sedation the positive charge may be used. For neurasthenic conditions the positive spray, or the stronger negative spray, either stationary or mobile, followed later by the lightest, shortest sparks.

When a patient is under other forms of treatment for hysteria or neurasthenia it is usually necessary to suspend applications during the menstrual periods. At these times the static spray or static charge may be substituted with advantage, maintaining the treatment without the harmful break that often interferes with quick results. That no disrobing is required for this application is a distinct advantage at this time. Menstrual discomfort is lessened, and no risk of causing an undue flow is encountered as might be the case with the galvanic current.

The treatment of menorrhagia of the neural type may be conducted, at times, entirely with the static currents, the negative spray being directed to the lumbar region, with the patient sitting sidewise on a chair placed on the platform and grasping a chain connected with the positive pole. The spray should be strong enough to produce distinct stinging sensations, and may be followed by light sparks to the same spot and to the hypogastric region. These applications are always helpful at and before the menstrual periods in nervous women, particularly if the nervous symptoms present at these times are attended by scanty flow.

For the treatment of the nervous disorders of the menopause, either natural or when artificially produced by ovariectomy, the static methods are often extremely useful, rendering the employment of neurotic and sedative medicines unnecessary. Both the head-spray and general sparks may be used.

Production of Roentgen Rays by the Static Machine.—Roentgen, or x-, rays have heretofore been most largely serviceable in the surgery of the bones and of missiles imbedded in the body, the fleshy organs and such morbid conditions as come under the notice of the gynecologist.

cologist casting but slight shadows on the fluoroscope and photographic plate. Recent reports of the action of these rays on the skin

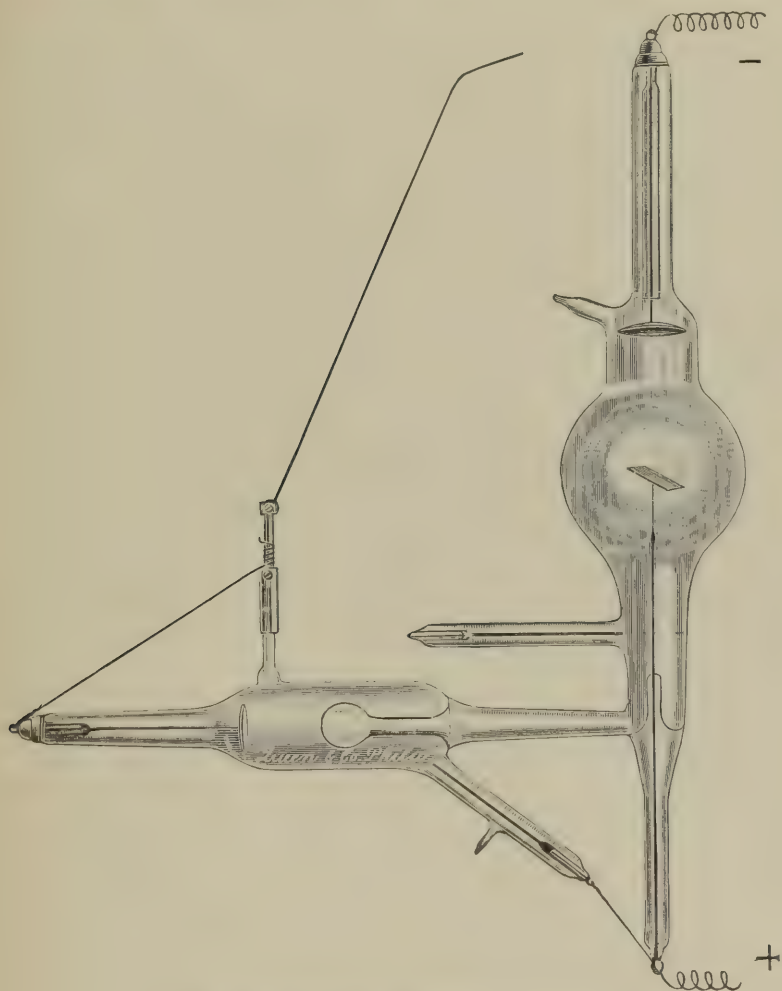


Fig. 114.—Queen self-regulating x-ray tube.

have added an element of possible therapeutic usefulness to their consideration, however; and, in view of the fact that a static machine, such as is indispensable in the larger work of the neuro-gynecologist,

forms also an excellent means of exciting a Crookes tube for this work, a few remarks are added on this method of producing the rays.

The only instruments needed in addition to the static machine are the tube, a stand for holding it, and a fluoroscope, rendering the outlay quite small for this special use of the machine.

Even the smaller static machines will excite tubes made with an appropriate exhaustion, but the best results are obtained from the large instruments, preferably one with from six to ten revolving plates of large diameter. The tube, which should be of the "focus" type, should be specially suited to the machine, the dimensions and character of the machine being given to the tube manufacturer before it is purchased.

The long, doubly-insulated terminals of the focus-tube are specially useful when the static machine is employed as exciter. In use the short tube attached to the middle of the bulb is gently, but firmly, clamped in the stand in such a position that the opposite side of the bulb is toward the object to be radiographed. The concave electrode must be attached to the cathode, or negative pole, of the machine by a light wire and the platinum plate to the anode. In action the cathode rays proceed from the concave electrode and focus on the anode, from which spot they issue in a powerful stream and impinge on the glass. It is at the glass surface that the Roentgen rays become separated from the cathode rays, the latter not penetrating the glass.

The method of making connections is shown in Fig. 115. It is necessary to have the condensers in circuit (and a size of condenser must be selected to suit the tube), with the rods well separated and a spark-gap somewhere in the circuit; this is easily accomplished by slipping a ring on one rod-handle to give a short spark; or a neater arrangement is the author's spark-regulators, which are attached to the hard-rubber handles near the brass portion of the rods. One wire is attached to the binding-post on the regulator and the other to the brass parts of the opposite pole, which should have its rod well drawn back. The wires for this purpose should be very light, to avoid too much traction on the tube.

The best way to ascertain which pole of the machine is the cathode and which the anode (and in some machines they are liable to change from time to time) is to bring the discharging-rods close together and start the machine; the resulting spark will be bright

and solid next to the anode and bluish next the cathode. If a mistake is made and the tube is connected wrong a ring of light appears at its equator and no lighting up of the fluoroscope will occur.



Fig. 115.—Arrangement of static machine for the production of Roentgen rays.

The machine should be run at full speed for the production of Roentgen rays.

It is well settled that the dermatitis that follows x-ray exposure at times is extremely unlikely to be encountered when the rays are produced by the static machine instead of the usual coil.

CHAPTER XXVII.

THE SINUSOIDAL AND INCANDESCENT ALTERNATING CURRENTS.

The Sinusoidal Current.—For a number of years the author has been aware that the successful production of muscular stimulation

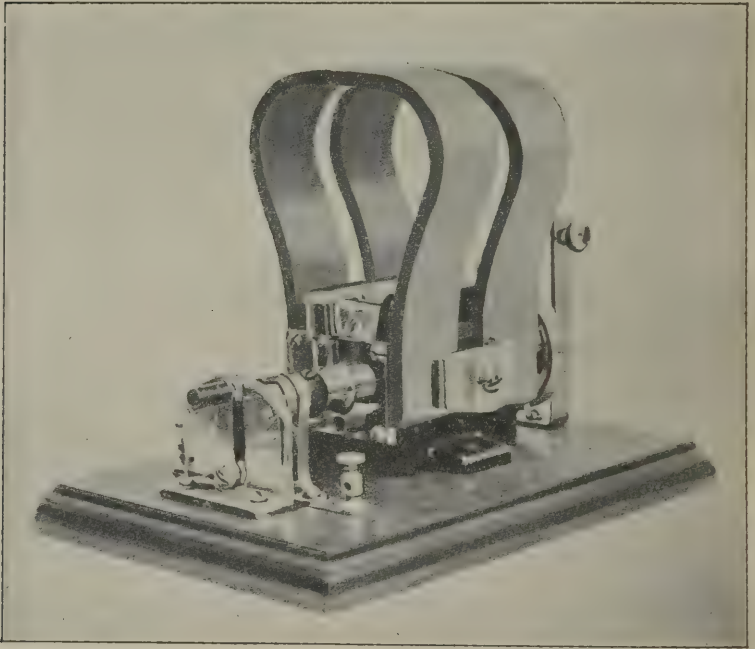


Fig. 116.—The Kellogg sinusoidal apparatus.

with a minimum of pain was largely dependent on the smoothness and clearness of the note produced by a good interrupter of a faradic apparatus; that “raggedness” or irregularity of these very imperfect

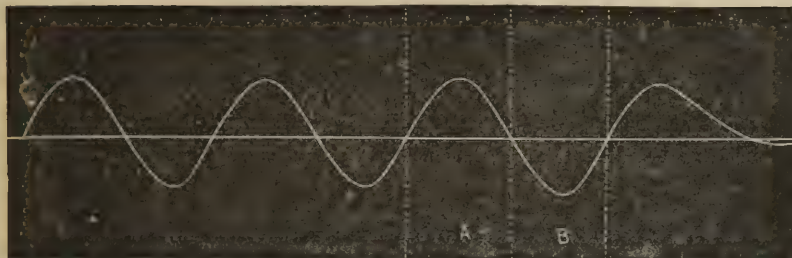


Fig. 117.—Graphic representation of the sinusoidal current of Dr. Kellogg's apparatus. (Kellogg.)

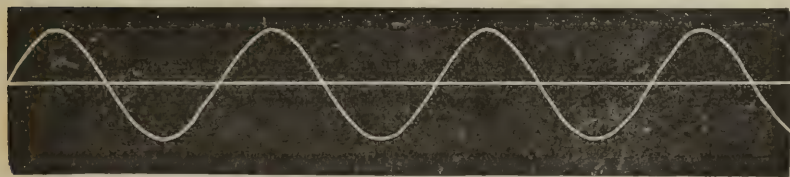


Fig. 118.—Sinusoidal curve obtained by d'Arsonval.

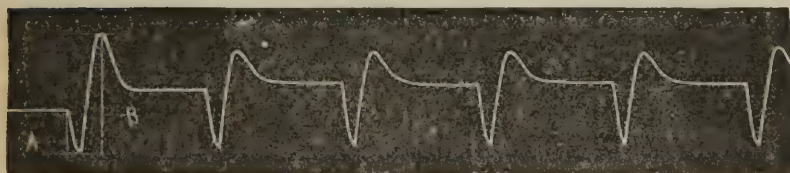


Fig. 119.—Current from faradic apparatus (McIntosh). *A*, make; *B*, break. (Kellogg.)

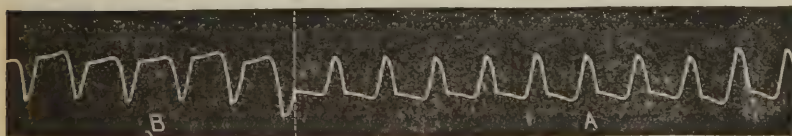


Fig. 120.—*A*, current from faradic apparatus (McIntosh), same as Fig. 114, but with different adjustment of the rheotome; *B*, current reversed. (Kellogg.)

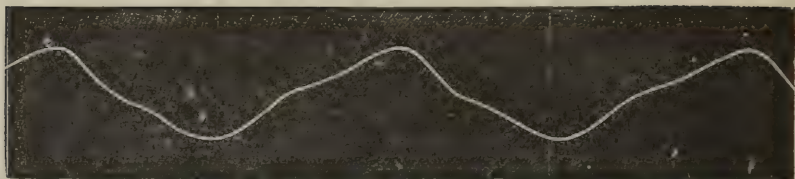


Fig. 121.—Representation of magneto-electric current not sinusoidal in character. (Kellogg.)

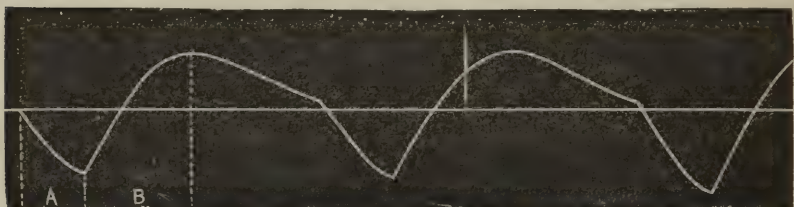


Fig. 122.—Current from du Bois-Reymond coil. *A*, make; *B*, break. (Kellogg.)

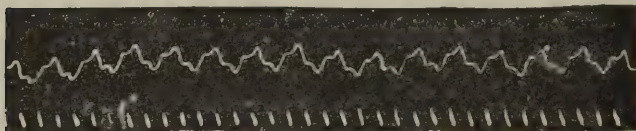


Fig. 123.—Characteristic marking of the rapidly-successive inductions of a poor faradic coil. The time-markings indicate $\frac{1}{280}$ second each. (Kellogg.)

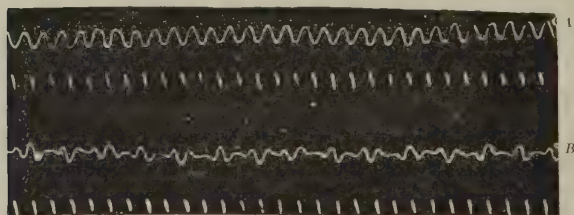


Fig. 124.—*A*, current from coil excited by Thompson-Houston are light, alternating 16,800 times per minute; *B*, current from secondary coil of ordinary faradic apparatus excited by alternating current. Time-markings represent intervals of $\frac{1}{280}$ second. (Kellogg.)

means of interrupting the inducing current produced induced currents that were of limited contraction-usefulness on account of the pain produced. While on a visit to Dr. J. H. Kellogg in the summer of 1887 he was surprised to find a magneto-electric machine in use in his operating-room which produced vigorous contractions with but slight sensation (Fig. 116). The exact reason for this was not known until the researches of Professor d'Arsonval, of Paris, several years later, on the graphic delineation of the curves of induced currents, showed that a curve of smooth and uniform rise of potential produced painless contraction, while irregular rises and falls of potential



Fig. 125.—McIntosh sinusoidal apparatus, with motor.

were painful. By means of an electrograph the curves of current-variation may be readily recorded on a revolving cylinder, the accompanying figures (117 and 118) representing the curves thus obtained by d'Arsonval and from Dr. Kellogg's apparatus. The curves shown in Figs. 119 to 124 are in marked contrast to these, showing the ragged character of the irregular rises and falls of potential and explaining the pain-producing character of all faradic currents of any considerable volume.

The sinusoidal current has a smooth and gradual variation, consisting of both an equal rise of potential above and fall below the

zero-line. This latter curve of variation represents the highest and most painless efficiency in muscle-stimulation with slight ampère, the contraction being proportional, of course, to the three elements of volts of rise, suddenness of rise, and milliamperage of current.

It is thus seen that the sinusoidal current is typically adapted

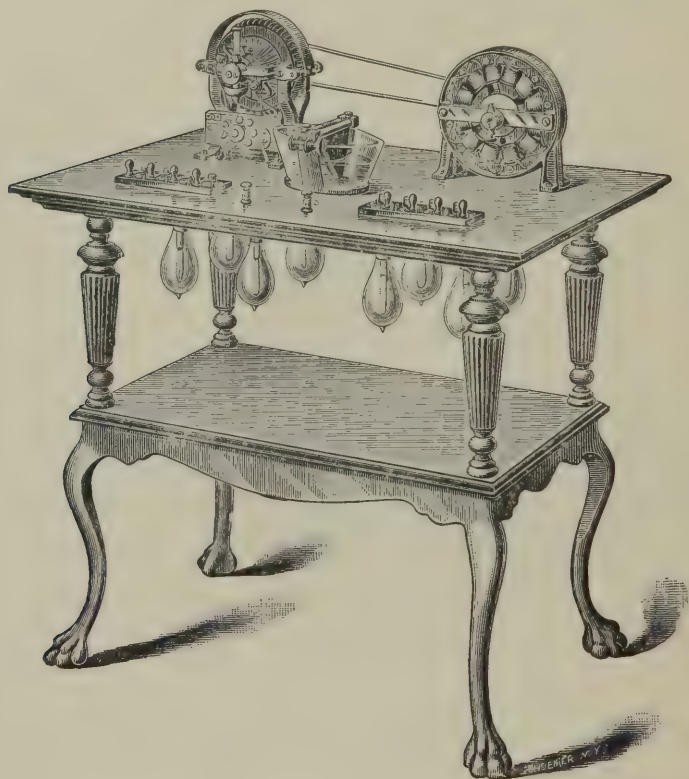


Fig. 126.—Kennelly sinusoidal apparatus and motor.

for muscular stimulation, for by properly constructed apparatus we may apply a far greater milliamperage for this purpose than the pain-producing qualities of the primary faradic current will permit. The exact milliamperage of these currents is yet undetermined, depending on the current circulating around the field-magnets of the alternator, but that it is usually intermediate between the galvanic and faradic

is shown by the fact that they will readily stimulate the special senses of sight and taste.

The ease with which a large number of complete alternations per second of this smooth character can be obtained adapt the sinusoidal current also as a nerve-sedative.

Sinusoidal currents are produced by little alternating-current



Fig. 127.—Shaw's acid carbon cell, of large size, for running motors, lighting small lamps, etc.

dynamamos, with either permanent magnets or electro-magnets, which are operated by any convenient source of power, an electric motor being the best. The patient is placed in a shunt circuit with a Massey controller, which is operated in a reverse manner,—that is, the lever is placed all the way around on the nickel-plated base of the graphite area at the start, when all the current goes through the instrument instead of the patient; by turning the current off the controller gradually it will increase through the patient's circuit with equal step.

The only drawback to this instrument as compared with faradic apparatus is its bulkiness and the fact that from two to four large acid-carbon motor cells must be used to operate it and the motor, or four times as many Edison-Laland cells, in the absence of the more convenient street-current.

The Incandescent Alternating Current.—This current, which is very largely used at present as an illuminant of houses and offices, is obtained from step-down transformers placed on the exterior of the house, by means of which the high voltage of the street-mains is reduced to either 50 or 104 volts, according to the transformer used and the lamps supplied. It may be employed in medical applications in place of the faradic, but, not being truly sinusoidal in character, is generally painful even when greatly reduced. The author's current-controller forms an efficient means for its control, when protected by a small fuse, the instrument being simply intercalated between one wire from a lamp-socket and the patient, the other wire from the lamp-socket going direct to the patient. As already said, this current is distinctly faradic in character and incapable of lasting electrolysis or cataphoresis. It can, in no sense, be employed as a galvanic current, therefore, in spite of the similar heat- and light-producing effects in the large ampèrage traversing the filament of the lamp.

There is, at least, one emergency in which its modern ubiquity may make it of service in saving life,—namely, in post-partum hemorrhage in a house supplied with this current and where a battery is not to be had. The cord of a drop-light could be unwound and one wire applied by coiling it in a wet pad to be placed on the back, while the other is dipped in a dish of water; a third wire from the opposite side of the dish of water going to a pad on the abdomen. When the wires in the water are brought closer or when a little table-salt is dropped into it, a means of gradually increasing the current to the point of tolerance is thus readily produced, with powerful contracting effects on the relaxed uterus.

CHAPTER XXVIII.

ELECTRIC LIGHT AS AN ILLUMINANT AND AS A THERAPEUTIC AGENT.

Direct Illumination of the Vagina.—Various methods have been devised for illuminating the vagina through the speculum by both reflected light and direct light produced by incandescent lamps. As

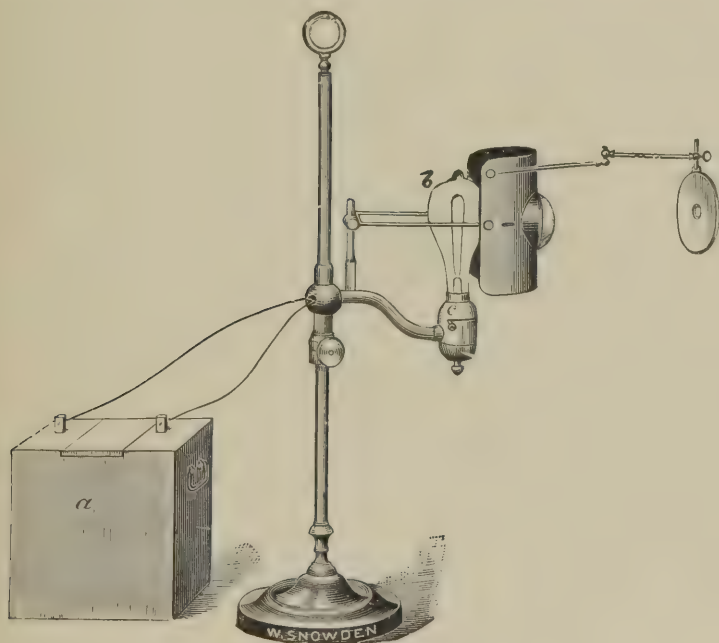


Fig. 128.—Sajous's lamp-holder and stand.

a source of light to be reflected from a mirror, there is no special advantage in the incandescent light where a Welsbach burner or acetylene-light is obtainable; in fact, it is inferior to either of these, though at times more convenient on account of its readier movability. Either a 16-, 32-, or 50-candle lamp is essential if the light is to be

reflected by a head-mirror, and the use of these lamps, of course, necessitates the taking of current from street-mains, as any kind of primary or secondary batteries of the voltage required would be both too troublesome and too expensive in maintenance. The light may be fixed on a holder or held by a second person. Of portable electric lights Sajous's lamp-holder and stand is shown in Fig. 128, but there is a mistake evident in the attachment of so small a portable battery, or any portable battery, to a lamp described as having a resistance of sixty ohms, which is intended for a current of at least fifty volts. Sajous also describes¹ the search-light of C. W. Isaac, of London (Fig. 129), consisting of a lamp mounted on a movable base of hard rubber within a tube in which it slides, in the front portion of which is set a parabolic mirror so adjusted that the arch of the filament is as near as possible coincident with its focal point. The mouth of the

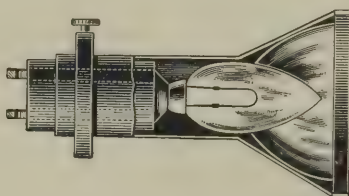


Fig. 129.—Isaac's search-light.

reflector is closed by a small glass cover, which protects the lamp and prevents the silver from being quickly tarnished. A mirror arranged in this way would doubtless be an improvement on Phillips's head-lamp or if placed behind the filament of a 50-candle lamp on the Sajous stand would be better than the Tobold condenser shown. As imported, this lamp is intended for a smaller lamp supplied by a battery.

Owing to the interference of the knees and the general position of the patient during a gynecic examination, the use of the head-mirror and reflected light is more inconvenient than is the case in other medical work, and better illumination is accomplished by the

¹ "International System of Electro-Therapeutics," page I-6. Philadelphia: The F. A. Davis Co.

use of miniature lamps carried on a head-piece in such a way that the light projects between the eyes in a line with the line of vision. These small lamps have the added advantage that they may be supplied with current from a few large acid motor cells in the office or portable storage cells of a few volts elsewhere. The best of this kind of apparatus is that devised by Dr. W. C. Phillips, of New York (Fig. 130). This is light of weight, easy of adjustment, and has a good lens. The instrument consists of a narrow, but strong, steel band, similar to Fox's, lined throughout with fibre. Attached by a rotary-motion joint is a small condenser which carries a 4-candle-power lamp of four or six volts. By means of a thumb-screw at the side of the



Fig. 130.—Phillips's electric head-light for four- or six- volt lamp.

condenser the focus may be easily and quickly regulated without removing the lamp from the head. To furnish the current for this lamp in office-work the best generator is the Shaw acid-carbon cell (Fig. 127), two of which should be coupled up in series for 4-volt lamps and three for 6-volt lamps. In case a German-silver-wire controller or rheostat is used with these cells, an additional cell will add to the length of time that the fluid can be used. The fluid requires to be renewed quite often. The storage battery is more expensive, but more convenient, if an Edison circuit is convenient for charging, but in the absence of this facility the storage battery is a nuisance, except as an expensive means to obtain a portable light.

Small lamps mounted on slender holders may be held in the

speculum for examination, but are in the way in case manipulations are necessary.

Transillumination of the Pelvis.—The fact that limited thicknesses of the body, such as the finger and part of the palm, may readily become translucent to the rays of even a moderately strong light seems to have been lost sight of as a means of diagnosis until the laryngologists took it up in 1888, when Cozzolino, of Naples, followed by Voltolini, of Breslau, illuminated the walls of the nose and accessory cavities and the larynx; the former by miniature lamps within the closed nostril or mouth, and the latter by a lamp on the outside of the neck, covered by an obturator, the light being perceived by the use of a laryngoscopic mirror within the dark pharynx.

The application of the principles thus disclosed to gynecology has been retarded by the greater thickness of the body in this situa-

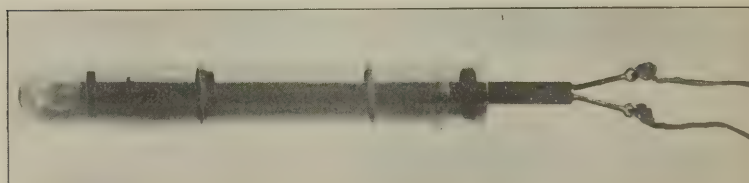


Fig. 131.—Author's pelvic transilluminator.

tion, rendering the miniature lamps that are capable of being introduced ineffective as a source of light. I have, however, myself succeeded in illuminating the abdomens of moderately thin women by the lamp devised by me (Fig. 131), which consists of a 6- or 8-volt lamp mounted on a holder in front of a plane reflector, and the whole inclosed within two test-tubes separated by rubber bands. The special advantage of this arrangement is the two air-spaces separated by the test-tubes, reducing the radiation of heat and permitting ready cleansing. The abdomen is illuminated by a reddish glow half-way to the navel. This light is, however, insufficient to illuminate the tissues in case of fat, or corpulent, patients, and, as the value of the procedure hinges on the absence of transmission as an evidence of pus accumulations and possibly tumors of dense consistence, it is evident that a more powerful light is necessary. This may be obtainable in the

Jackson apparatus (Fig. 132), though I have not tried it, which employs the principle discovered by Belin in 1889, that a glass rod will transmit rays of light to its extremity without heat if the rod is silvered, the rod even being capable of being bent into various shapes. The apparatus is of two parts,—an electric lamp of 50-candle power and a silvered glass rod. The lamp is inclosed in a case silvered within and blackened without. Projecting from the side of the case is a metal neck into which fits a perforated asbestos cork; through the cork passes the glass rod, which is also silvered over except at the ends, the silvering being protected by varnish. The brilliant light

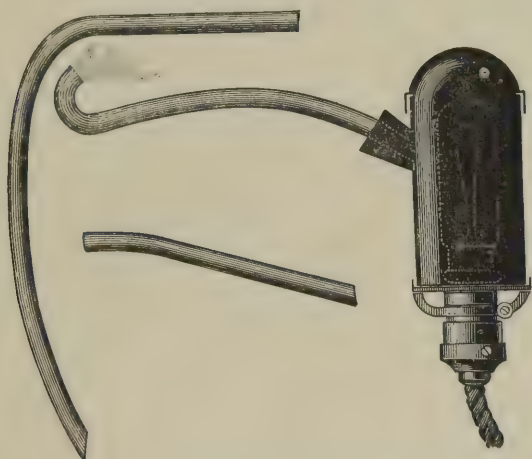


Fig. 132.—Apparatus of Chevalier Jackson as arranged for transillumination of the nasal passages and antrum.

within the lamp-case is transmitted axially through this rod and issues from the distal end with undiminished brilliancy. The rod does not get hot, and should be slightly warmed before insertion.

Another mode of obtaining transillumination of the pelvis is to place a 32- or 50-candle-power lamp over the abdomen in a conical receiver made to exclude all light except that which traverses the skin and abdominal walls; if a speculum be then placed in the vagina the tissues will be seen to shine with a red glow.

All work in transillumination should be done in a thoroughly darkened room.

The value of transillumination is limited by the fact that all living tissues appear nearly the same in color and shade. It is im-

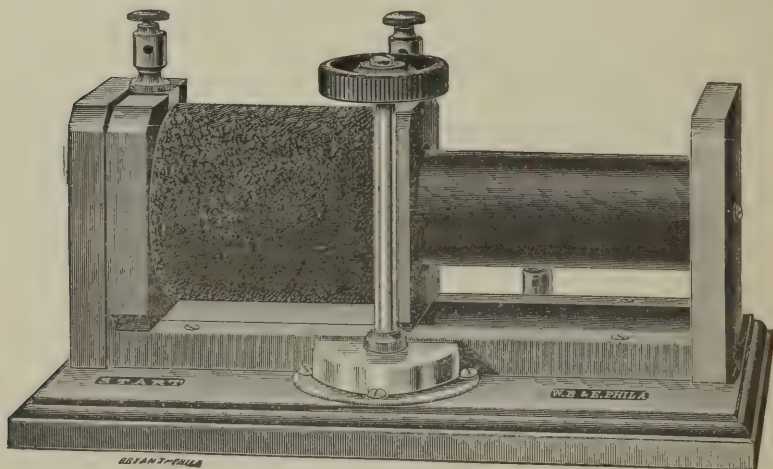


Fig. 133.—Alternating current-transformer of Williams, Brown & Earle.

possible to make out the anatomical parts except the large veins and the bones, and these only by a darker shading. Accumulations of

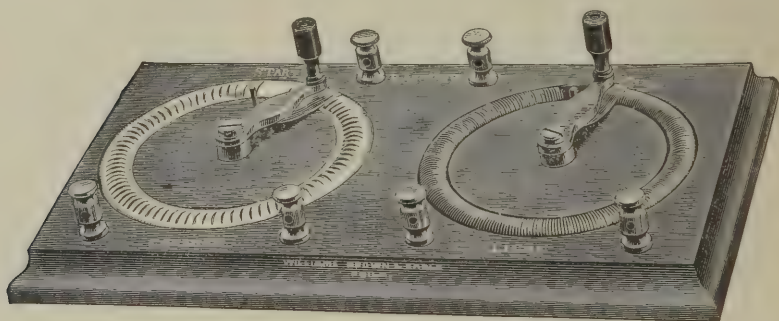


Fig. 134.—Controller for lighting small lamps and heating cautery-loops from Edison current.

pus will appear as a dark shadow, while cystic tumors are lighter than their surroundings. No light is transmitted if there be extensive exudations, and dense fibroids and possibly cancerous tumors cast a

shadow or interfere with transmission. Hematomas should also be opaque, if the general rule holds good that dead tissue is opaque to the rays.

With a satisfactory source of light, the value of this procedure in diagnosis is evident.¹

Electric Light as a Therapeutic Agent.¹—The therapeutic use of

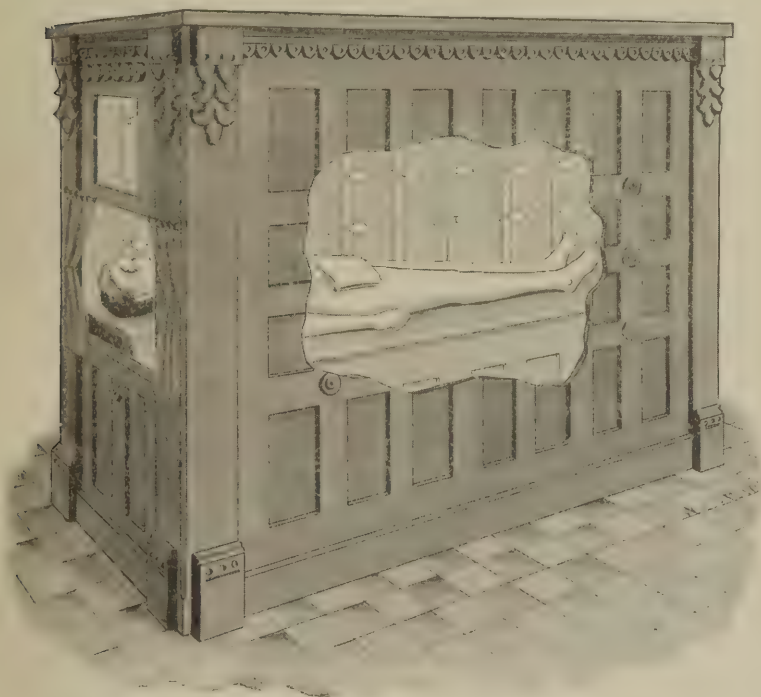


Fig. 135.—The Kellogg electric-light-bath cabinet.

electric light is mainly due to the facility with which an application of radiant heat may be made to the whole or a part of the body. A 16-candle light inclosed in a bell-shaped shield placed over a painful

¹ For Report of Standing Committee on "Electric Light as a Diagnostic and Therapeutic Agent," see the Transactions of the American Electro-Therapeutic Association, page 295, 1894.

spot will quickly and pleasantly do all that a hot application can do to relieve pain and possibly more, for it may be that the effect is due as much to the penetration of light to the nerve as it is to the heat. Such an application will be followed by a circumscribed redness, and repeated applications will tan the skin like sunlight. Moist heat—a radiant poultice—may be applied locally by wrapping the lamp in wet cloths (leaving the base of the lamp unmoistened, of course).

Dr. J. H. Kellogg has detailed a series of experiments on the physiologic effect of the electric-light, or radiant-heat, bath in a paper before the Americal Electro-Therapeutic Association.¹ He employed a cabinet lined with mirrors and containing sixty incandescent lamps, so arranged that the patient lies in an horizontal position, the lights being placed on three sides (Fig. 135). The patient lies on a suitable

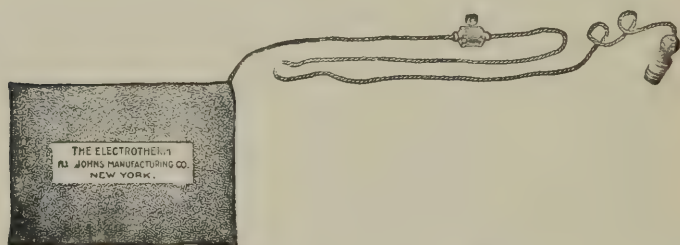


Fig. 136.—The electrotherm: an electric heating pad for replacing hot-water bags and bottles.

couch with rollers, which is pushed entirely within the cabinet, or only so far as to expose such portions of the body as it is desirable to bring under the influence of radiant heat and light. It is only necessary to protect, by a sheet and piece of mackintosh, any portion of the body which it is desired to exclude from the action of the bath.

The results of his investigation showed that the electric-light bath was superior to either the Turkish or Russian baths in stimulating vicarious elimination by the skin, the amount of perspiration induced being fully double that induced by the Turkish bath in the same time.

¹ Transactions of the American Electro-Therapeutic Association, page 153 1894.

The electrotherm, or electric hot pad (Fig. 136), is an excellent substitute for a hot-water bag for local applications of heat to the body, the special advantage of the instrument being the maintenance of the desired heat for any length of time required, in which it is incomparably superior to hot-water bags.

APPENDIX A.

TABLE OF EIGHTY-SIX CONSECUTIVE CASES OF FIBROMATA,
WITH DETAILS OF TREATMENT AND
ULTIMATE RESULTS.

TABLE OF EIGHTY-SIX CONSECUTIVE CASES OF FIBROMATA UTERI UNDER ELECTRIC TREATMENT.

No. of Case.	REFERRED BY OR TREATED AT	AGE OF PATIENT.	KNOWN DURA- TION OF GROWTH.	DESCRIPTION OF GROWTH.	CLINICAL SYMPTOMS.	METHOD OF TREAT- MENT.	RESULTS.	TIME AFTER CESSA- TION OF TREATMENT WHEN RESULTS WERE VERIFIED.
1		45	4 years.	Interstitial growth, size of cocoa-nut, projecting into right broad ligament.	Pressure on bladder and menorrhagia.	Buried puncture, —, 60 to 200 ma. at intervals of a week, followed by intra- uterine.	Sympt. cure and early reduction of size one-third. Re- cent report of pa- tient says growth has disappeared.	10 years.
2		47	20 years.	Interstitial and sub- peritoneal multi- nodular growth fill- ing abdomen to 4 inches above umbil- icus.	General pressure symptoms and im- pairment of health.	Intra-uterine, 100 to 200 ma., eight times, daily.	Temporary aggrava- tion of pain due to frequency of treat- ment; subsequent improvement.	1 year.
3	Dr. H. A. Kelly, Balti- more.	49	5 years.	Submucous, sessile fibrocyst, enlarging uterus symmetric- ally to size of seventh month of pregnancy.	Bloody and watery discharge, pain, and general impairment of health.	Intra-uterine, — and +, 25 to 300 ma. every other day un- til os dilated and tumor presented.	Septicemia occurred during expulsion of tumor, followed by death on the twelfth day.	
4	Dr. T. Hew- son Bradford, Philadelphia.	38	2 years.	Submucous sessile polyp of small size; uterus hypertro- phied; cavity four inches.	Pain and purulent leucorrhœa.	Intra-uterine, — and +, 40 to 150 ma.; ten applications.	Relief of symptoms; reduction of tumor to a nodule and of uterus to normal size.	

5	Dr. T. Hewson Bradford, Philadelphia.	38	2 years (?).	Intramural, multinodular growth, filling abdomen and extending two inches above navel.	Profuse and hastened periods, severe pain, and difficult locomotion.	Intra-uterine, + and —, 65 to 150 ma. at intervals of week or more.	Sympt. cure; patient reports disappearance.	8 years.
6	Dr. F. Woodbury, Philadelphia.	41	12 years.	Subperitoneal and intramural multinodular growth, extremely hard, filling pelvis and lower third of abdomen.	Constant pain, aggravated at periods, which were of 2-week type, and profuse, offensive, purulent leucorrhœa.	Intra-uterine, 60 to 200 ma. — twice weekly. Later once weekly.	Patient reports disappearance. The discharge quickly cured.	4 years.
7	Dr. Bradford, Philadelphia.	34	9 mos.	Intramural growth filling pelvis, with subperitoneal projection reaching crest of the ilium.	Constant pain in left groin and on walking, with profuse, purulent leucorrhœa.	Intra-uterine, —, 50 to 150 ma. twice a week.	Disappearance of tumor and of all symptoms, and reduction of uterus to normal size. Bands of adhesion left.	8 years.
8	Dr. William Pepper, Philadelphia.	40	1½ years.	Intramural symmetric fibroid of large size, wedged in pelvis and extending to the navel.	Severe pain, inflammatory attacks, pressure symptoms, and impairment of health.	Intra-uterine, 80 to 250 ma. — every other day. Later, every fourth day.	Quick release upward into abdomen, with improvement of health; subsequent reduction to two inches below navel (one-third).	2½ years.
9	Dr. Bradford, Philadelphia.	42	1 year.	Intramural nodule, 2 inches in diameter, in posterior wall of retroflexed uterus.	Pain and other pressure symptoms, with menorrhagia and profuse purulent leucorrhœa.	Intra-uterine, 50 to 125 ma. — twice weekly, with intervals of non-attendance.	Sympt. relief and considerable shrinkage.	3 mos.

TABLE OF EIGHTY-SIX CONSECUTIVE CASES OF FIBROMATA UTERI UNDER ELECTRIC TREATMENT (*continued*).

No. of Case.	REFERRED BY OR TREATED AT	AGE OF PATIENT	KNOWN DURA- TION OF GROWTH.	DESCRIPTION OF GROWTH.	CLINICAL SYMPTOMS.	METHOD OF TREAT- MENT.	RESULTS.	TIME AFTER CESSATION OF TREATMENT WHEN RESULTS WERE VERIFIED.
10	Dr. Bradford, Philadelphia.	33	2 mos.	Interstitial growth, size of small orange, in retroverted uterus.	Flooding two weeks at last period, with constant pressure symptoms.	Intra-uterine, +, 25 to 100 ma. twice a week, with inter- vals of non-attend- ance.	Menstruation regu- lar and normal, and sympt. cure. Pa- tient shortly after died under opera- tion which was forced on her against her wishes.	
11	Dr. Bradford, Philadelphia.	30	1 year.	Interstitial, size of fist, in right side of fundus; cervix elon- gated; syphilitic history.	Hemorrhages at periods, which are irregular and fre- quent; profuse leu- corrhea and painful locomotion.	Intra-uterine, +, 35 to 100 ma. once a week, with intervals of non-attendance.	Menstruation regu- lar and painless, relief of pain, and slight reduction in size.	
12		36	1 year.	Two subperitoneal pedunculated growths sizes of large orange and lemon, sepa. attach.	No symptoms.	Intra-uterine, 30 to 50.	No change.	3 mos.
13	Dr. William Goodell, Phil- adelphia.	48	6 years.	Submucous, size of large adult head, at- tached by broad base; os admitting two fingers. Growth rapid.	Continuous and dan- gerous hemorrhages, with pain and im- pairment of health.	Intra-uterine, + and -, 70 to 350 ma. every other day.	Arrest of bleeding and menstruation for three months, followed by dis- charge of a fibrous mass and complete disappearance of re- mainder.	9 years.

14	Howard Hospital.	25	2 years.	Interstitial, size of large lemon, in anterior wall. Perimetric adhesions.	Irritable bladder, pain in back, and painful locomotion.	Intra-uterine, —, 35 to 50 ma. twice a week.	Relief of symptoms; no record of change of size.	
15	Howard Hospital.	40	3 years.	Interstitial growth, size of lemon, in posterior wall of retroflexed uterus, occupying Douglas's pouch.	Severe pain, pressure, profuse hemorrhage, and leucorrhea. Menstruates every 21 days.	Intra-uterine, +, 50 to 125 twice a week.	Arrest of hemorrhage, restoration of menses to 28-day type, and slight reduction in size.	1 month.
16	Dr. Bradford, Philadelphia.	28	3 years.	Interstitial growth filling pelvis. Uterus retroverted. Syphilitic history.	Hemorrhagic periods and constant pain.	Buried puncture, —, 200, three times, and intra-uterine, +, 50 to 100 once a week.	Relief of pain, regulation of menstruation, and considerable reduction in size.	6 mos.
17	Howard Hospital.	34	2 years.	Interstitial growth filling pelvis and extending above level of upper spines of ilium.	Profuse hemorrhage and impairment of health.	Intra-uterine, +, 60 to 110 ma. twice a week.	Total disappearance of tumor. Uterus normal in size. Menstruation normal. Hemorrhage arrested.	3 mos.
18	Howard Hospital.	23	Unknown.	Interstitial, size of an orange, in anterior wall.	Excessive menorrhagia and antipated periods. Very tender in hypogastrium.	Intra-uterine, —, 30 to 70 once a week.	No record. Case lost sight of.	

TABLE OF EIGHTY-SIX CONSECUTIVE CASES OF FIBROMATA UTERI UNDER ELECTRIC TREATMENT (continued).

No. of Case.	Referred by or Treated at	Age of Patient.	Known Dura- tion of Growth.	Description of Growth.	Clinical Symptoms.	Method of Treat- ment.	Results.	Time After Cessation of Treatment When Results Were Verified.
19	Howard Hos- pital.	50	14 years.	Subperitoneal nod- ular, filling pelvis and abdomen and extending to ribs. Treatment confined to nodule in Doug- las's pouch.	Pressure symptoms, affecting rectum and bladder especially.	Puncture, + and —, 50 to 100 ma., six times.	Nodule in pelvis smaller and flatter. Pressure symptoms lessened, and bowels move more freely.	
20	Howard Hos- pital.	30	6 years.	Interstitial enlarge- ment of fundus to a size that fills pelvis. Multinuclear, firmly adherent. Cavity, 3½ inches.	Hemorrhagic periods 21-day type, with menorrhagia and tenderness.	Intra-uterine, +, 60, followed by — vag., 40. The first treat- ment caused pro- longed hemorrhage and pain.	No sign of tumor ex- cept lumps in tubal region. Uterus nor- mal in size and movable. No pain. Periods regular.	6 mos.
21	Howard Hos- pital.	40	2 mos. (?).	Interstitial globular, size of large cocoa- nut, in posterior wall. Cavity, 4 inches.	Constant hemorrhage and pain. Bladder irritable.	Intra-uterine, +, 30, four times.	Disappearance of pain.	
22	Howard Hos- pital.	40	1 year.	Interstitial, size of goose-egg, in left wall, extending above level of true pelvis.	Pain, fever, irrita- bility of bladder, and irregular men- struation.	Intra-uterine, —, 30 to 60 ma.	Complete disappear- ance of projection and symptoms.	1½ mos.

23	Howard Hospital.	45	Unknown.	Interstitial, size of cocoa-nut, in anterior wall, extending to upper level of ilium. Cavity, 4½ inches.	Hemorrhage and pain.	Intra-uterine, +, 20 to 80 ma., six times.	Hemorrhage arrested by first application. Subsequent relief of pain. No record of change of size.	
24		41	2 years.	Intramural, growth posterior and to left. Whole mass size of goose-egg. Cavity, 3½ inches.	Immense loss of blood at periods of 21-day type. Pain and tenderness and profuse leucorrhea. General health impaired.	Intra-uterine, 15 to 100 ma., +, twice a week, later once a week.	Complete disappearance of growth, the cavity shrinking to 2½ inches. Periods normal, without flooding or pain.	8 years.
25	Howard Hospital.	36	14 years.	Interstitial growth in anterior wall, nearly filling pelvis. Cavity, 3½ inches.	Flooding at periods, with pain, tenderness, and leucorrhea.	Intra-uterine, +, 35 to 45, five times.	Flooding arrested and improvement of symptoms.	1½ years.
26	Howard Hospital.	33	2 years.	Interstitial involvement of whole uterus, including cervix, filling pelvis and extending to crest of iliac bones.	Flowing every day for two years; no tenderness and no adhesions.	Intra-uterine, +, 50 to 85 ma. once a week.	Hemorrhage ceased after first application.	
27	Howard Hospital.	40	2 mos. (?)	Intramural growth, size of goose-egg, in anterior wall.	Pain and bladder pressure, with much local tenderness. Menstruation irregular. Leucorrhea profuse.	Intra-uterine, + and -, 20 to 50 ma. twice a week.	Complete sympt. cure and reduction of tumor to the size of a walnut. It is now subperitoneal. Menses normal.	1 year.

TABLE OF EIGHTY-SIX CONSECUTIVE CASES OF FIBROMATA UTERI UNDER ELECTRIC TREATMENT (*continued*).

No. of Case.	REFERRED BY OR TREATED AT	AGE OF PATIENT.	KNOWN DURA- TION OF GROWTH.	DESCRIPTION OF GROWTH.	CLINICAL SYMPTOMS.	METHOD OF TREAT- MENT.	RESULTS.	TIME AFTER CESSATION OF TREATMENT WHEN RESULTS WERE VERIFIED.
28	Dr. William Goodell, Phil- adelphia.	47	7 years.	Interstitial extending an inch above navel, with a cystic projection on right containing "cells of Drys- dale."	Attacks of intense pain at periods, in which tumor swells several times larger, impinging on ribs; no hemorrhage. Health impaired.	Intra-uterine, + and -, 40 to 150 twice weekly, changed to abdomino-dorsal al- ternatives, 150 ma., after 3 mos., with aspiration of cysts.	Reduction of solid part of tumor to size of orange; subse- quent increase of cystic portion. Op- eration advised, under which patient succumbed.	
29	Dr. A. W. Watson, Phil- adelphia.	29	9 mos.	Intramural and sub- peritoneal projec- tion from right cornu, reaching to 1½ inches below navel. Cavity, 3½ inches.	Menstrual flooding every 3 weeks, with constant pain and tenderness. Menor- rhalgia.	Intra-uterine, +, 25 to 70 once a week, with intervals. Vag- inal applications for a time.	Symptomatic im- provement. Tumor slightly smaller and more disengaged. Later was operated on. Present health poor.	4 years.
30	Dr. Wharton Sinkler, Phil- adelphia.	44	12 years.	Interstitial enlarge- ment of uterus, with projections to both sides. Elec- trode inserted 3½ inches.	Menstrual cramps re- quiring physician and morphia regu- larly. Flow lasts two weeks and is profuse.	Intra-uterine, +, 20 to 60 about twice a week. Cramps fol- lowed treatment.	Relief of pain and restoration of nor- mal flow (5 days). Tumor distinctly smaller.	7 mos.
31		30	1 year.	Intramural growth, size of large lemon, in left wall.	Constant bleeding, lasting for months, requiring rest in bed; constant pain and tenderness; copious leucorrhœa.	Intra-uterine, +, 20 to 30, six times, with one + vag. 100.	Relief of pain, hemor- rhage, and leucor- rhea. No notes of change in size.	

32	Dr. E. L. Duer, Philadelphia.	46	2 years.	Interstitial enlargement of uterus to size of child's head, extending to 3 inches below navel.	Former attacks of bleeding at present pain and pressure symptoms.	Intra-uterine, — and +, 20 to 70 ma.; later intra-uterine alternatives, 70 to 100 ma. once a week.	Cure of all symptoms and reduction to small nodule. Restoration of health perfect.	6 years.
33	Dr. Lusk, Penn Yan, N. Y.	45	6 years.	Subperitoneal growth, filling pelvis and extending to 1½ inches of navel, attached by sessile pedicle to fundus of uterus.	Pressure symptoms in moderate degree.	Vagino-abd. alternatives, 150 ma., with occasional intra-uterine, —, 30 to 100. Puncture im-possible, owing to bladder.	Release of tumor from pelvis upward into abdomen. Results otherwise negative.	1 year.
34	Dr. William Goodell, Philadelphia.	45	4 years.	Interstitial multinodular growth, size adult head, extending to 2 inches below navel.	Bleeding periods and local tenderness associated with bronzed skin, anemia, and neurasthenia.	Vagino-abd. alternatives, 100 ma. once a week. Intra-uterine treatment not well borne.	Normal periods, great improvement in health, and slight reduction in size.	2 years.
35	Dr. T. C. Davis, Bridge-ton, N. J.	50	Dis-covery recent.	Subperitoneal sessile growth, extending from Douglas's pouch to 2 inches below navel. Nar-row, movable.	Retention of urine occurring frequently caused tumor to be dis-covered. Much pain in left leg. Menses free.	Buried puncture, —, 100 to 150 ma. every two weeks.	Complete disappearance of tumor and restoration of health.	5 years.
36		36	5 years.	Intramural projection size of walnut from posterior wall. Cavity, 3½ inches. Enlarged ovary on right side.	Menorrhagia and menorrhagia at 3-week intervals. Constant pain and weight. Leucor-rhea.	Intra-uterine, +, 30 to 60 once a week, at intervals.	Normal periods, free from pain at 4-week intervals, with relief of weight symp- and reduction of cavity to 3 inches.	2 years.

TABLE OF EIGHTY-SIX CONSECUTIVE CASES OF FIBROMATA UTERI UNDER ELECTRIC TREATMENT (*continued*).

No. of Case.	REFERRED BY OR TREATED AT	AGE OF PATIENT.	KNOWN DURA- TION OF GROWTH.	DESCRIPTION OF GROWTH.	CLINICAL SYMPTOMS.	METHOD OF TREAT- MENT.	RESULTS.	TIME AFTER CESSATION OF TREATMENT WHEN RESULTS WERE VERIFIED.
37		52	5 years.	Intra-uterine fibroids polyp, size hen's egg.	Exsanguinated by excessive and long continued hemor- rhages.	Intra-uterine faradic to extrude tumor. After expulsion, re- moval by torsion. Base treated by + galv., 40.	Removal of tumor and restoration of health.	1 year.
38	Dr. G. H. Whitcomb, Greenwich, N. Y.	46	3 years.	Interstitial fibroid mass reaching to 1½ inches of navel, about size of adult head.	Attacks of severe pain; lameness and edema of right leg. Pain and local tenderness.	Intra-uterine, —, 125 following vaginal alternatives 80 to 125 twice a week.	Removal of lameness in 2 weeks. Later sympt. cure and complete disappear- ance of tumor.	6 years.
39	Howard Hos- pital.	40	15 years.	Intramural fibroid size of large apple in posterior wall.	Tenderness and pressure on bladder. Old history of hem- orrhages.	Intra-uterine, + and —, 30 to 80 once or twice a month.	Sympt. cure and con- siderable reduction in size.	6 mos.
40	Howard Hos- pital.	29	6 years.	Interstitial growth enlarging uterus to size of orange.	Pain and profuse periods, the latter recurring every 2 weeks.	Intra-uterine, +, 15 to 30 ma.	Arrest of hemor- rhage and cure of symptoms. Great reduction in size.	6 mos.
41	Howard Hos- pital.	37	6 years.	Intramural growth in posterior wall, filling pelvis and extending 2 inches above symphysis.	Pain and profuse periods. Bladder much affected by pressure.	Buried puncture, —, 250 ma. six times, well borne. Intra- uterine badly borne.	Partial relief of pain by puncture and tumor reduced be- low symphysis. Abscess of ovary coincident and oper- ated upon, with fatal results.	

42	Howard Hospital.	40	12 years.	Intramural and sub-peritoneal growth filling abdomen to 1½ inches above navel. Syphilitic suspicion.	Pain and profuse periods. Locomotion painful.	Buried puncture, —, 200 ma., and intra-uterine, +, 30 to 50 weekly, at intervals, later abdominal puncture 100 ma., —.	Relief of pain. Menstruation regular and less free. Patient reports that the tumor has disappeared.	
43	Howard Hospital.	29	5 years.	Interstitial size of sweet potato.	Pain, profuse and frequent periods. Was opened and operation abandoned three years ago.	Vag., +, 30 to 100 twice a week.	Symptomatic cure. No change in size.	6 mos.
44	Howard Hospital.	48	7 years.	Submucous growth enlarging uterus to fill pelvis and reaching to half inch of navel.	Bleeding profusely for several years. Now nearly extinguished. Much pain.	Intra-uterine, +, 60 ma.	Arrest of hemorrhage and later extrusion of tumor <i>per vaginam</i> .	4 years.
45	Dr. Philip Marvel, Atlantic City, N. J.	42	1 year.	Symmetrically enlarged uterus to size of orange. Os admits sound only.	Has been flooding almost constantly for a year, with much pain. Ergot ineffectual.	Intra-uterine, +, 40, followed by delivery of tumor size pullet's egg. Subsequent cauterization of base.	Anatomical and symptomatic cure.	5 years.
46		45	15 years.	Symmetric ovoid abdom. tumor size of ninth month of pregnancy 4½ inches above navel; semi-elastic. Circumference, 37 inches.	Hemorrhages and pain. Increase of size marked in past year.	Abdominal punct., —, 60 to 300 ma.	Sympt. cure and reduction of tumor to size of lemon.	3 years.

TABLE OF EIGHTY-SIX CONSECUTIVE CASES OF FIBROMATA UTERI UNDER ELECTRIC TREATMENT (*continued*).

NO. OF CASE.	REFERRED BY OR TREATED AT	AGE OF PATIENT.	KNOWN DURATION OF GROWTH.	DESCRIPTION OF GROWTH.	CLINICAL SYMPTOMS.	METHOD OF TREATMENT.	RESULTS.	CESSATION OF TREATMENT WHEN RESULTS WERE VERIFIED.
47	Dr. William Goodell, Philadelphia.	27	6 years.	Symmetric ovoid abd. tumor size of adult head extending to 1 inch above navel.	Health prostrated from exhausting hemorrhages.	Intra-uterine, +, 50 to 250 ma.; later abdominal punct., 200 ma., —.	Arrest of hemorrhage and restoration of health. Anatomical change but slight at last report.	2 years.
48	Dr. A. W. Knox, Raleigh, N.C.	52	4 years.	Growth on anterior aspect of uterus extending to navel. Capacious cavity 4 inches deep.	Continuous bloody disch. for a year, with pain; two attacks of pelvic inflammation. Tenderness in left ovary.	Intra-uterine, +, 25 to 100 ma.	Symptomatic cure and reduction of tumor about one-half.	4 years.
49		41	3 years.	Interstitial growth of uterus size of orange, with projection to left, size of walnut.	Pain in ovarian regions for 11 years, aggravated by sitting posture. Severe menorrhagia.	Intra-uterine, —, 30 to 60 ma., followed by sec. faradic for relief of pain.	Relief of pain, arrest of growth, and slight diminution in size.	Recent.
50		35	4 years.	3-lobed abdominal tumor, one reaching to ribs. Cavity, 5 inches.	Exsanguinated from excessive menstrual periods.	Intra-uterine, +, 50 to 100.	Cure of hemorrhage. No note of reduction of size.	Lost sight of.
51		33	10 years.	Large abdominal tumor extending 5 inches above navel, of soft consistence.	Was cured of hemorrhage previously by electricity under Dr. Drysdale. Now but little discomfort.	External applications, strong galv. and farad. currents.	Temporary reductions in size that were not permanent. Operation advised, which was successful.	

52	Dr. James Barton, Philadelphia.	43	8 years.	Immense abdominal tumor, 42 $\frac{1}{2}$ inches around waist, filling abdomen and displacing bladder in front of pubes.	Severe hemorrhages, and weight and size causing great deformity. An operation had been attempted and abandoned.	Abdominal punct., —, 200 to 400 ma.	Symptomatic cure and slight reduction in size.	3 years.
53		46	7 years.	Multinodular abdominal tumor, highest point 2 inches above navel. Cavity, 5 inches.	Hemorrhages, attacks of pain, and constant tenderness.	Intra-uterine, +, 50 to 75 ma.; flexible electrode.	Symptomatic cure and slight reduction in size, after limited treatment.	4 years.
54		35	3 years.	Interstitial growth of uterus to size of hen's egg.	Persistent menorrhagia.	Intra-uterine, +, 50 to 75 ma. Sectional carbon electrode.	Patient lost sight of.	
55	Dr. R. M. Slaughter, Theolog. Seminary, Va.	40	6 years.	Interstitial abdominal tumor, size of adult head; upper limit 3 inches above navel. Cavity, 6 inches.	Frequent alarming hemorrhages and impaired health. Is growing larger.	Intra-uterine, +, 100 to 250 ma. Carbon electrode.	Cure of hemorrhages, reduction to 1 inch above navel, and restoration of health.	2 years.
56	Dr. William Goodell, Philadelphia.	45	3 years.	Interstitial pelvic tumor size of large orange. Cavity, 5 inches.	Exhausting hemorrhages and impairment of health.	Intra-uterine, +, 45 to 75. Rigid electrode.	Cure of hemorrhages, reduction of size, and restoration of health.	3 years.
57		35	4 years.	Multinodular abdominal tumor size of two fists. Cavity, 3 $\frac{1}{2}$ inches, tortuous and narrow.	Profuse periods, hemorrhagic at times; pain and tenderness.	Intra-uterine, +, and alternatives, 50 to 100 ma.	Symptomatic cure and some reduction in size.	Recent.

TABLE OF EIGHTY-SIX CONSECUTIVE CASES OF FIBROMATA UTERI UNDER ELECTRIC TREATMENT (*continued*).

No. of Case.	REFERRED BY OR TREATED AT	AGE OF PATIENT.	KNOWN DURATION OF GROWTH.	DESCRIPTION OF GROWTH.	CLINICAL SYMPTOMS.	METHOD OF TREATMENT.	RESULTS.	TIME AFTER CESSATION OF TREATMENT WHEN RESULTS WERE VERIFIED.
58	Dr. Lawrence Wolf, Philadelphia.	40	3 years.	Interstitial and sub-peritoneal abdominal tumor extending 3 inches above navel. Cavity, 4 inches. Tortuous.	Menorrhagia and tenderness with leucorrhœa, but little pain.	Intra-uterine alt., 60 to 150 ma., followed by faradic.	Symptomatic cure and reduction to 1½ inches above navel.	Recent.
59	Howard Hospital.	40	2 years.	Interstitial abdominal tumor, extending to navel.	Hemorrhagic and tender, and has suppression of urine from pressure.	Intra-uterine, +, 60 to 75, and vag. appl. for short period.	Symptomatic cure; no note of reduction in size.	Lost sight of.
60	Dr. S. M. Ross, Altoona, Pa.	29	2 years.	Interstitial pelvic tumor size of lemon posterior to fundus.	Menorrhagia and pain, with feeling of weight.	Intra-uterine, +, 50 to 100 ma.	Symptomatic cure; no reliable information as to reduction.	
61	Drs. Hemminger and Bixler, Carlisle, Pa.	39	7 years.	Intra-uterine sessile fibroid, thoroughly cystic and vascular, size of seventh month of pregnancy. Os dilated.	Constant watery, at times bloody, discharge, and impairment of health.	Bipolar intra-uterine punctures, 400 to 700 ma.	Complete destruction of intra-uterine tumor and reduction of nodular uterus to size of a lemon.	3 years.
62		40	3 years.	Interstitial abdominal tumor size of adult head, extending 3 inches above navel, with ascitic fluid in peritoneum.	Constant bleeding and shortness of breath on walking.	Intra-uterine, +, 50 to 60 for short time.	Reduction in flow to normal. No change in size. Subsequently removed by Dr. Kelly.	

63	Dr. S. S. Maynard, Frederick, Md.	50	13 years.	Interstitial pelvic tumor of fundus, the whole about the size of a fist.	Some pain and tenderness; had been greatly relieved by previous attendant under electricity.	Intra-uterine, —, 30 to 50 ma., and vag. galv.	Symptomatic cure, arrest of growth, and some reduction in size.	4 years.
64	Dr. William Goodell, Philadelphia.	32	8 years.	Interstitial pelvic tumor of fundus about size of goose-egg.	Menorrhagia and severe attacks of pain. Had been opened by a surgeon who desisted from removal.	Intra-uterine, —, 30 to 40; mainly vaginal on account of pain.	Improvement of symptoms.	Recent.
65	Dr. A. W. Knox, Raleigh, N. C.	34	1 year.	Multiple interstitial and subperitoneal tumor size of an orange.	Pain and pressure on bladder.	Intra-uterine, +, 40 to 80 ma.	Symptomatic cure and slight reduction in size.	
66	Dr. J. Chambers, Kingston, N. Y.	46	6 mos.	Interstitial pelvic tumor size of hen's egg, with peritoneal tenderness. Cavity, 3½ inches.	Hemorrhagic periods; severe pain in ovarian regions. Just recovered from peritonitis.	+ vagino-abd. followed by intra-uterine, —, 30.	Symptomatic cure and distinct reduction in size.	3 years.
67	Dr. J. Reynolds, Potsdam, N. Y.	43	2 years.	Interstitial abdominal tumor of large size to ½ inch below navel. Cavity, 4 inches.	Growing rapidly and had become very uncomfortable.	Intra-uterine, —, 40 to 50.	Arrest of growth for 8 months after short treatment, and symptomatic cure to date of report.	1 year.
68	Dr. T. C. Rich, Williamsport, Pa.	45	8 years.	Very large abdominal tumor, size of uterus at term.	Exsanguinated and cachectic from constant hemorrhages and recent attack of peritonitis. Temp. 101°.	Intra-uterine, +, 100 to 200 ma.; carbon electrode, alternating with vaginal galv.	Surprising restoration of health, following gradual cessation of hemorrhages; later diminution of size.	6 mos.

TABLE OF EIGHTY-SIX CONSECUTIVE CASES OF FIBROMATA UTERI UNDER ELECTRIC TREATMENT (*continued*).

No. of Case.	REFERRED BY OR TREATED AT	AGE OF PATIENT.	KNOWN DURATION OF GROWTH.	DESCRIPTION OF GROWTH.	CLINICAL SYMPTOMS.	METHOD OF TREATMENT.	RESULTS.	TIME AFTER CESSATION OF TREATMENT WHEN RESULTS WERE VERIFIED.
69	Howard Hospital.	48	Unknown.	Abdominal tumor, interstitial, extending to 1 inch below navel. Cavity entered 3 inches.	No symptoms particularly pointing to tumor. Patient has lupus of skin.	Intra-uterine, +, 20 to 60 ma.	Reduction in size to 2½ inches below navel.	6 mos.
70		34	4 years.	Multinodular interstitial and subperitoneal tumor about size of fist.	Tenderness extreme, menstruation scanty.	Intra-uterine, —, 60 to 80 ma. Later, — vaginal puncture, 200 ma.	No continuous relief of tenderness, and tumor still growing.	Recent.
71		47	9 mos.	Interstitial pelvic tumor, size of fist.	Hemorrhages every 3 weeks for 3 years. Very profuse; now almost constant.	Intra-uterine, +, 50 to 100 ma.	Symptomatic cure and great reduction in size.	2½ years.
72	Dr. H. W. Elmer, Bridgeton, N. J.	54	4 years.	Multinodular pelvic tumor size of fist (suspicion of malignancy).	Constant hemorrhages for several years, with impairment of health.	Intra-uterine, +, 50 to 150 ma. Carbon electrodes; later zinc-amalgam cathodes 50 to 100 ma.	Arrest of hemorrhages and improvement of symptoms. Tumor probably smaller.	2 years.
73		46	5 years.	Interstitial abdominal tumor size of egg-plant, extending to 2½ inches of navel. Cavity, 4 inches.	Hemorrhages at periods and some impairment of health.	Intra-uterine, +, 40 to 100 ma.	Symptomatic cure and some reduction in size.	2 years.

74	Dr. F. H. Martin, Chicago, Ill.	30	6 years.	Interstitial pelvic tumor size of large fist.	Profuse periods. Tumor again growing after operation for tying broad ligaments. Adherent vag. sinus.	Intra-uterine, +, 25 to 60 mra.	Symptomatic improvement in pain and hemorrhage. Tumor smaller.	No advice since treatment.
75		38	3 years.	Interstitial pelvic tumor of fundus, size of pullet's egg. Cavity, 3 +, retroflexed.	Hemorrhagic periods. Lane in left leg from pressure. Health depressed.	Intra-uterine, +, 50 to 75, flexible cotton-covered electrode interspersed with vag. galv.	Disappearance of hemorrhages, limp, and other symptoms, and some reduction in size.	6 mos.
76	Howard Hospital.	52	Unknown.	Interstitial pelvic tumor of fundus about 2 inches in diameter, projecting into Douglas's pouch.	Occasional hemorrhages, some tenderness, and impairment of health.	Intra-uterine, +, 50, and vag. galv.	Disappearance of tumor and symptomatic cure.	1 year.
77	Dr. W. S. Jauncey, Philadelphia.	43	6 mos.	Interstitial abdominal tumor filling lower abdomen to 2 inches above navel.	Hemorrhagic periods, tenderness, and general impairment of health.	Intra-uterine, zinc-amalgam cataphoresis, 40 to 80 +.	Symptomatic cure and considerable reduction in size.	Recent.
78		26	Recent.	Interstitial pelvic tumor, size of coconut. Cavity, 4 inches.	Pain and menorrhagia.	Intra-uterine, +, 35, flexible electrode, on six occasions.	Symptomatic cure.	Lost sight of.
79	Dr. Thomas Drysdale, Philadelphia.	45	4 years.	Interstitial abdominal tumor size of adult head, filling lower half of abdomen to navel. Cavity, 6½ inches.	Frequent hemorrhages and menorrhagia, with pain, leucorrhœa, and impaired health.	Intra-uterine, +, 200, sectional elect.; later zinc-amalgam cataphoresis.	Symptomatic cure and reduction to 2 inches below navel.	Recent.

TABLE OF EIGHTY-SIX CONSECUTIVE CASES OF FIBROMATA UTERI UNDER ELECTRIC TREATMENT (*concluded*).

NO. OF CASE.	REFERRED BY OR TREATED AT	AGE OF PATIENT.	KNOWN DURATION OF GROWTH.	DESCRIPTION OF GROWTH.	CLINICAL SYMPTOMS.	METHOD OF TREATMENT.	RESULTS.	TIME AFTER CESSATION OF TREATMENT WHEN RESULTS WERE VERIFIED.
80	Dr. R. H. Hamill, Philadelphia.	40	5 years.	Multinodular abdominal tumor of large size, 2½ inches above navel.	Mens. twice a month with constant pain.	Intra-uterine, +, 100 on eight occasions.	Unknown. Tumor subsequently removed by Dr. Hamill.	
81	Howard Hospital.	27	1 year.	Symmetric abdominal tumor ½ inch above navel. Cavity very narrow.	Hemorrhagic periods and very profuse muco-purulent leucorrhea.	Intra-uterine, +, 30 to 150.	Symptomatic cure. No record of change in size.	
82	Howard Hospital.	35	Uncertain.	Large mass of firm texture and irregular shape posterior to uterus, apparently connected.	Several attacks of peritonitis and constant pain.	Vag., +, 50 to 150.	Symptomatic cure and much reduction in size.	1 year.
83	Howard Hospital.	37	10 years.	Very large abdominal tumor—waist, 36½ inches circumference—extending 13½ inches above pubes.	Hemorrhages and pressure symptoms.	Intra-uterine, +, 75 on several occasions.	Results unknown.	

84	Howard Hospital.	40	1 year.	Large abdominal tumor extending 3½ inches above navel.	Hemorrhage and pressure symptoms.	Intra-uterine, +, 30 to 150.	Results unknown.	
85	Howard Hospital.	34	2 years.	Interstitial pelvic tumor, size of coconut, firmly fixed.	Profuse hemorrhages, and attacks of peritonitis. Health impaired.	Intra-uterine, +, 100; later zinc-analgam cataphoresis, 75.	Symptomatic improvement. No change in size.	Recent.
86	Howard Hospital.	48	2 years.	Multinodular abdominal tumor extending 1 inch above navel.	Cramplike pain in abdomen.	Intra-uterine, +, 125 enema; flexible electrode.	Symptomatic cure and reduction of tumor to 1 inch below navel.	1 year.

For an analysis of this table see page 141.

APPENDIX B.

TABLE OF THIRTY-FOUR CONSECUTIVE CASES OF CATARRHAL
DISEASE OF UTERUS UNDER ELECTRIC
TREATMENT.

TABLE OF THIRTY-FOUR CONSECUTIVE CASES OF CATARRHAL

NO. OF CASE.	AGE.	DURATION OF DISEASE.	DEPTH OF CAVITY, INCHES.	MOBILITY.	DISCHARGES.
1	34	15 years	3½	Fixed	Slight muco-pus
2	27	1 year	¾	Movable	Hemorrhagic leucor.
3	26	2 years	3	Movable	Hemorrhage, leucor.
4	34	8 years	3½ later 2½	Fixed	Profuse, purulent
5	•21	2 years	3 to 2½	Movable	Profuse, purulent
6	22	1 year	2½	Movable	Inconstant mucoid
7	38	3 years	3	Movable	Inconstant mucoid
8	23	3 years	3½ later 2½	Movable	Constant muco-pus
9	36	9 years	3	Movable	None at present
10	27	8 years	3	Adherent	Copious purulent
11	28	8 years	3	Movable	Copious mucoid
12	32	8 years	3+ later 2½	Movable	Slight inconstant
13	27	4 years	3	Adherent to left	Inconstant
14	25	2 years	2½	Movable	Profuse muco-pus
15	25	3 years	2½	Movable	Profuse
16	37	7 years	not sounded	Fixed	Copious purulent
17	22	16 mos.	¾ to 2½	Movable	Copious mucoid
18	31	6 years	4 to 2¾	Movable	Moderate mucoid
19	30	9 years	3	Movable	Copious muco-pus
20	21	3 years	¾ to 2½	Movable	Mucoid
21	25	18 mos.	3	Movable	Slight mucoid

DISEASE OF UTERUS UNDER ELECTRIC TREATMENT.

CONDITION OF UTERUS.	COMPLICATIONS.	MODE OF TREATMENT.	RESULTS.
Moderately hypertrophied	Left salpingitis; deep laceration of cervix	— vag. followed by — intra-uterine, 15	Cure, followed by pregnancy
Corporeal hypertrophy	Deep stellate laceration of cervix	+ intra-uterine flex. elect. 30 and vaginal galv.	Improved
Slight enlargement	Retroversion and stenosis	+ intra-uterine, 25 (twice only)	Cure, followed by pregnancy
Corporeal hypertrophy	Monolateral laceration	+ intra-uterine, 25 to 65, with flexible elect.	Improved, followed by pregnancy
Normal size	Severe menorrhagia	+ and — intra-uterine, 8 to 25, and vag. galv.	Cured
Some enlargement	Severe menorrhagia	+ intra-uterine, 50 to 40	Cured, followed by two pregnancies
Hypertrophied	First degree of prolapse	+ intra-uterine, 70, and prim. farad.	Cure, with improvement of prolapse
Hypertrophied	Tenderness in left ovarian region	— intra-uterine, 10 to 25, and + vag., 70	Cured
Moderate hyper.	Menorrhagia	+ intra-uterine, 15 to 25, and vag. galv.	Cured
Hypertrophied with large cavity	A lacerated cervix had been repaired without relief	+ intra-uterine, 35, and gen. galv.	Cured
Corpus 2 inches in diameter, cavity large	A lacerated cervix had been repaired without relief	— intra-uterine, 20 to 35, and — vag.	Improved
Capacious cavity	Tender and enlarged ovary	+ intra-uterine, 20 to 35, and — vag. galv.	Cured
Moderate hyper.		— vag., 60, and farad. and + intra-uterine, 20	Symptomatic cure, adhesions remain
Slight hyper.	Menorrhagia	+ intra-uterine, once only	Cured, followed by pregnancy
Slight hyper.	Menorrhagia	+ intra-uterine, 20	Cured
Hyperplasia	Dense masses in region of both broad ligaments	+ vag., 100 to 150	Symptomatic cure, adhesions loosened
Engorged	Nervous prostration	+ intra-uterine, 20 to 25, and vag. galv.	Cured
Hyperplasia	Evidences of old pelvic inflam.	intra-uterine alternatives, 70, and vag. galv.	Cured, followed by pregnancy
Slight hyper.		+ intra-uterine, 20, and vag. galv.	Improved
Prolapsed uterus, with hyper.	Left ovary prolapsed	+ intra-uterine, flex. elect., 25 to 40, and vag. gal.	Cured, ovary still low
Hyperplasia	Nervous prost.	— intra-uterine, 20, and vag. galv.	Improved

TABLE OF THIRTY-FOUR CONSECUTIVE CASES OF CATARRHAL

NO. OF CASE.	AGE.	DURATION OF DISEASE.	DEPTH OF CAVITY, INCHES.	MOBILITY.	DISCHARGES.
22	29	7 years	3	Movable	Profuse muco-pur. hemorrhagic
23	24	7 years	3	Movable	Copious mucoid
24	24	3 years	2½	Movable	Copious purulent
25	22	4 years	3	Movable	Constant mucoid
26	26	6 years	3+	Adherent	Profuse offensive muco-pus
27	26	4 years	3	Movable	Profuse muco-pus
28	31	3 years	3	Movable	Profuse muco-pus
29	26	4 years	2¾	Adherent	Profuse purulent
30	40	2 years	3, later 2½	Movable	Hemorrhage, leucor.
31	30	3 years	3½	Movable	Mucoid
32	30	1 year	3	Fixed	Muco-pus
33	34	1 year	3, later 2½	Movable	Muco-pus
34	38	5 years	3½	Slightly adherent	Muco-pus

DISEASE OF UTERUS UNDER ELECTRIC TREATMENT (*concluded*).

CONDITION OF UTERUS.	COMPLICATIONS.	MODE OF TREATMENT.	RESULTS.
Stenosis, cervix	Menorrhagia	+ intra-uterine, 20 to 50	Cured
	Nervous prost.	+ intra-uterine, 25, and vag. galv. + Intra-uterine, flex. elect., 20 to 80, and vag. gal.	Improved Cured, followed by pregnancy
Moderate hyper.		+ intra-uterine, 20 to 35	Cured
Hyperplasia	Prolapse of both ovaries and enlargement of left ovary	+ and — intra-uterine, 20 to 30, and secondary faradic	Discharge cured and enlargement lessened
	Tenderness in ovarian regions	+ intra-uterine, 50	Cured
Hyperplasia		— intra-uterine, 50	Improved
	Tubes involved	— intra-uterine, 50, and vag. galv.	Cured
Hyperplasia		+ intra-uterine, 50	Cured, followed by pregnancy
	Tenderness and thickening at left broad lig.	— intra-uterine, 15 to 40 and neg. vag.	Cured
	Tenderness and thickening at both broad lig.	— intra-uterine, 35, preceded by — vag., 50	Symptomatic cure
Hyperplasia prolapsed and		— and + intra-uterine, 50 to 75	Improved
Hyperplasia prolapsed and		+ intra-uterine, 25 to 50 (for two months)	Greatly improved. Two years later hysterectomy for supposed cancer, with fatal results

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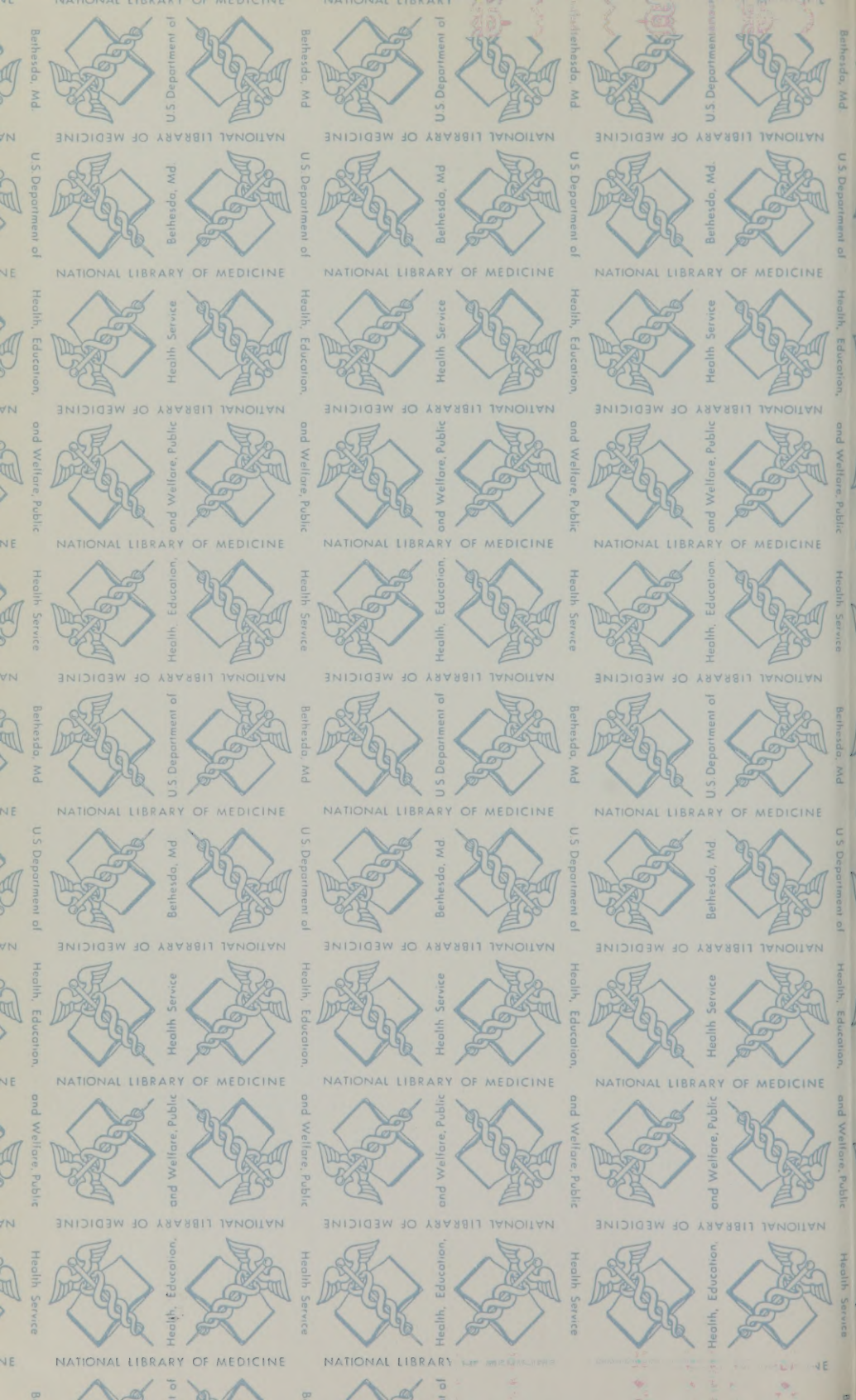
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